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INJECTION TECHNIQUES IN MUSCULOSKELETAL MEDICINE

A PRACTICAL MANUAL FOR CLINICIANS IN PRIMARY AND SECONDARY CARE

FOURTH EDITION

Foreword by Elaine Hay

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SECTION 1

INJECTION THERAPY – THE EVIDENCE

THE EVIDENCE BASE FOR INJECTION THERAPY

SECTION 1

OVERVIEW

Injection therapy is the treatment of musculoskeletal disorders by the targeted injection of drugs into joints and soft tissues.

Corticosteroid and local anaesthetic injection therapy has been in use for 60 years, and has stood the 'test of time'.[1] There is a wealth of anecdotal evidence for its efficacy, but few, if any, definitive studies,[1–5] and few studies comparing injection therapy with other treatments; the comparative studies that do exist mainly concern the shoulder and elbow, and their conclusions are contradictory.[6–20] Consequently, there are few facts and a mass of opinions – many of them dogmatic and contradictory – about almost every aspect of injection therapy[21–24] and published guidelines for joint and soft tissue injections are based more on personal experience and anecdote than on evidence.[1,4] This state of affairs is surprising, because injection therapy is the most common therapeutic intervention in rheumatological practice.[25]

Interpretation of injection therapy studies is compounded by a disconcerting lack of expert agreement about definitions, diagnosis, and outcome measures in musculoskeletal medicine,[1,26–31] coupled with wide variations in methodology and quality between trials. Because of this, most authoritative reviews tend to be conservative in their estimates of the presence and size of treatment effects in injection therapy.[3,5,32–43]

Nonetheless, injection therapy is recommended for musculoskeletal (mainly knee and shoulder) disorders in national and international guidelines [3,44–48] and is used extensively for other musculoskeletal conditions.[49,50] Given its relative safety,[1,3,5,51–53] ease of application in trained hands and cost-effectiveness,[3] plus the frequent lack of convincing systematic evidence for the effectiveness of alternatives,[38] injection therapy is a very useful treatment modality.[54] This is supported by the collective experience of the majority of clinicians in primary care and the locomotor specialties.[55]

Remarkably, there are hardly any double blind randomized controlled trials of intra-articular versus systemic corticosteroid injection therapy for the treatment of any inflammatory arthropathies. The superior clinical efficacy of joint injection therapy has been reported only recently in two trials comparing intra-articular to systemic injection of the same total dosage of triamcinolone in rheumatoid arthritis.

In the first randomized study, patients with polyarticular disease who were treated with intra-articular injections of triamcinolone demonstrated significantly better pain control and range of motion than did those who were treated with the same total dosage of mini-pulse systemic steroids. Patient evaluation

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of disease activity, tender joint count, blood pressure, side effects, physician contacts, and hospital visits were significantly better for those treated with intra-articular steroids.[56]

The second study compared the efficacy and safety of intra-articular corticosteroid injection with systemic injection of the same dose of triamcinolone for the treatment of monoarthritis of the knee in rheumatoid arthritis patients. The intra-articular approach showed better results in terms of local inflammatory variables and improvement evaluation by the patient and physician.[57]

However, in both studies the systemic treatment was given with triamcinolone *acetonide*, while the joints were injected with the far less soluble and longer acting triamcinolone *hexacetonide*. It could be argued that what these studies demonstrate is the superiority of the hexacetonide formulation of triamcinolone, rather than the route of administration.

The definitive randomized trial to demonstrate the superiority of the intra-articular route of corticosteroid administration in inflammatory joint disease is still awaited. Nonetheless, authoritative international guidelines recommend that intra-articular corticosteroid injections should be considered for the relief of local symptoms in patients with inflammatory arthritis.[58]

As with other treatment modalities, the challenge for all clinicians delivering injection therapy is to implement evidence-based practice by applying the best research-based treatments, tempered by clinical experience and patients' values.[59] Where good research evidence is lacking, clinicians should become involved in research that will provide that evidence.

Problems with injection therapy may arise when:

- ***an inappropriate drug*** is chosen
- too ***large*** a dose or volume is given
- the drug is put into the ***wrong tissue***
- ***poor technique*** allows spread of drugs to adjacent tissue
- injections are given too ***frequently***
- insufficient attention is directed to the ***cause*** of the ***lesion***
- no regard is given to ***aftercare*** and ***rehabilitation***.

The art of good injection therapy is to select the appropriate patient, and to place the minimal effective amount of an appropriate drug into the exact site of the affected tissue at an appropriate time. This means that the clinician using injection therapy must possess a high level of diagnostic and technical skill.

DELIVERY OF INJECTION THERAPY

Doctors in rheumatology, orthopaedics, musculoskeletal medicine, sports medicine, and pain management are the main medical specialists who deliver injection therapy.

Most general practitioners (GPs) in the UK carry out some joint and soft tissue injections, but limit themselves to knees, shoulders and elbows.[60] A small highly active group receives referrals from colleagues.[60,61] Most of the injections in the community are performed by just 5–15 % of GPs.[61,62] The main perceived barriers to performing these injections are inadequate training, the inability to maintain injection skills and discomfort or lack of confidence with the performance of the technique.[60–62] Training improves GPs' injection activity and their level of confidence.[63]

In 1995 chartered physiotherapists in the UK were granted the right to use injection therapy, whereupon the authors of this textbook developed the first training programme in this field and were lead contributors to the only published injection therapy guidelines.[64]

Injections administered by physiotherapists have been shown to be part of a very effective way of managing orthopaedic[65] and rheumatology [66] outpatients and patients in the community with musculoskeletal lesions.[67] Extended Scope Practitioners in physiotherapy have been shown to be as effective as orthopaedic surgeons and to generate lower initial direct hospital costs.[68] Podiatrists also deliver injection therapy for lower limb disorders and nurses have also been trained in musculoskeletal injection therapy.[69,70]

CURRENT CONTROVERSIES IN INJECTION THERAPY

Almost every aspect of injection therapy is non-standardized. Notwithstanding controversies about diagnosis, there is no universal agreement about the following:

- What are we treating – what is the pathological/biochemical cause for the pain?
- Are we always treating inflammation, or is the drug doing something else, e.g. modifying the action of nociceptors?
- Are there subgroups of potential injection responders within broad diagnostic categories e.g. 'shoulder pain' or 'back pain' and if so how can we identify them?
- Which options – which drug, dosage, volume, technique, venue, aftercare, co-intervention and/or rehabilitation should we advocate?
- When is the optimal time to inject in the course of any disorder?
- Should injections be repeated – if so at what intervals and how often?
- Who should be followed up – at what intervals and for how long?
- How much benefit is due to the placebo, the acupuncture or the fluid volume effect as opposed to any specific pharmacological effect?
- What is the role of other injectable drugs besides steroid and local anaesthetic?
- Is injected saline an analgesic? This may influence the interpretation of trials where saline was used as an (assumed) inactive control.[71,72]
- How useful is imaging? (See pages 44–59 and Appendix 1, Landmark technique accuracy and outcome studies.)
- Is a targeted injection more effective than a non-specific systemic one?[73–75]
- How much do patients' expectations and preferences affect the outcome?[76]
- How much mythology is there about injection therapy and how can we correct it?

THE RESEARCH AGENDA IN INJECTION THERAPY

Whither injection therapy? Given the large number of questions listed above we might reflect on why, after six decades, there is such a dearth of first-rate evidence for a therapeutic approach that is so well established and widely utilized. Certainly the research agenda should seek to address the points raised above, but why are published studies in the recent medical literature concerning

injection therapy with corticosteroid and local anaesthetic so relatively sparse? It may be that to some the benefits are so well established and self-evident that further research is unnecessary (we would vigorously disagree).

Certainly, newer agents may attract more interest because of their novelty value and (often unfulfilled) theoretical potential (see page 31, Other substances used for injection therapy).[77] Perhaps research into novel treatments is generously funded by manufacturers (with the potential for partial reporting of results), while research into inexpensive, familiar treatments attracts little or no support from industry and academia. There are undoubtedly other reasons.

Recommendations for future research abound in the papers cited in this book (far too numerous to mention here). A particular issue is that double blind randomized controlled studies comparing corticosteroid injection therapy with a placebo or another treatment all test a single injection (or initial cluster of injections) at the outset with the comparator, but in real life most clinicians empirically use repeated injections; the strategy of repeating the injection as required has never been explicitly tested for efficacy, safety and cost-effectiveness in a prospective trial.

One suggestion we fully endorse is that those systematically reviewing and meta-analysing the musculoskeletal literature should provide model research protocols, methodologies and frameworks that could be taken 'off the shelf' and utilized by anyone sufficiently enthused to participate in injection therapy research.

November 2010 was the 350th anniversary of that bastion of scientific enquiry, *The Royal Society*. Anyone who aspires to best evidence based practice should bear in mind the society's motto: '*nulius in verba*' – take nobody's word for it.

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CORTICOSTEROIDS AND LOCAL ANAESTHETICS

CORTICOSTEROIDS

Corticosteroids were first administered systemically in 1948 by Philip Hench in the USA[7] and were hailed as the new 'universal panacea', but it soon became apparent that there were major side-effects that greatly limited their systemic use.[1,2] In 1951 Hollander in the USA reported the first use of local hydrocortisone injections for arthritic joints.[8]

The commonly used injectable corticosteroids are synthetic analogues of the adrenal glucocorticoid hormone cortisol (hydrocortisone), which is secreted by the innermost layer (zona reticularis) of the adrenal cortex. Cortisol has many important actions including anti-inflammatory activity. Corticosteroids influence the cells involved in the immune and inflammatory responses primarily by modulating the transcription of a large number of genes. They act directly on nuclear steroid receptors to control the rate of synthesis of mRNA.[3] However, they also reduce the production of a wide range of pro-inflammatory mediators including cytokines and other important enzymes.[1,2,4–6]

RATIONALE FOR USING CORTICOSTEROIDS

We know surprisingly little about the precise pharmacological effects of corticosteroids when they are injected directly into joints and soft tissues.[9–11]

Local steroid injections are thought to work by:

- ***Suppressing inflammation*** in inflammatory systemic diseases such as rheumatoid or psoriatic arthritis, gout, etc.[2,4,12–15] Synovial cell infiltration and proinflammatory cytokine expression are reduced in a multifaceted manner by intra-articular corticosteroid injection.[4]
- ***Suppressing inflammatory flares*** in degenerative joint disease.[3,14,16] However, the pathophysiology of osteoarthritis is poorly understood,[17] and there are no reliable clinical features that predict which osteoarthritic joints will respond to injection. Often, the only way to find out is with an empirical trial of injection therapy.[14,16]
- ***Breaking up the inflammatory damage–repair–damage cycle*** which is postulated to set up a continuous low-grade inflammatory response, inhibiting tissue repair and sound scar formation, while forming adverse adhesions.[18,19] There is little direct evidence to support this, however.[10]

- ***Protecting cartilage:*** there may be a direct chondroprotective effect on cartilage metabolism or other effects not related to anti-inflammatory activity of the steroids e.g. promotion of articular surfactant production.[3,6,20–28]
- ***Direct analgesic effect:*** inflammation is a complex cascade of molecular and cellular events.[29,30] The precise role of inflammation in 'tendinitis' is the subject of considerable debate, and many authors prefer the terms 'tendinosis' or 'tendinopathy' to describe the pathological changes.[29,30] Tendon pain may not be due to inflammation (tendinitis) or structural disruption of the tendon fibres (tendinosis), but might instead be caused by the stimulation of nociceptors by chemicals such as glutamate, substance P and chondroitin sulphate released from the damaged tendon.[31,32] Corticosteroids (and possibly local anaesthetics) may inhibit release of noxious chemicals and/or the long-term behaviour of local nociceptors. In vitro, corticosteroids have also been shown to inhibit the transmission of pain along unmyelinated C-fibres by direct membrane action.[33]

COMMONLY USED CORTICOSTEROIDS

- **Triamcinolone acetonide**
  Adcortyl (10 mg/ml – dilute)
  Kenalog (40 mg/ml – concentrated)

Throughout the book we recommend Kenalog for ease of administration. This drug can be used in very small quantities so is ideal for small joints and tendons where distension may increase pain. Adcortyl, however, is useful where larger volume is required as in larger joints and bursae. The duration of action of the drug is approximately 2–3 weeks.[34,35] (Triamcinolone hexacetonide – *Lederspan* – was the least soluble and longest lasting injectable drug previously available in the UK but the manufacturer withdrew it in 2001. It is still available from Sandoz in the USA as *Aristospan*).

- **Methylprednisolone acetate**
  Depo-Medrone (40 mg/ml – concentrated)

This drug may give more post-injection pain than triamcinalone acetonide.[36] It is available also pre-mixed with local anaesthetic as Depo-Medrone (40 mg/1 ml) with Lidocaine (10 mg/ml) in 1 ml and 2 ml vials, which we do not recommend as it is a fixed-dose combination and therefore difficult to adjust.

- **Hydrocortisone**
  Hydrocortistab (25 mg/ml)

Very soluble – this has the shortest duration of action of the steroids mentioned here, perhaps as little as 6 days.[11] It may be particularly useful for superficial injections in thin, dark-skinned patients, where depigmentation or local fat atrophy may be more noticeable. 20 mg of Hydrocortistab is equivalent to 4 mg of triamcinolone or methylprednisolone (Table 1.1).

Table 1.1 Commonly used corticosteroids

Drug	Dose	Potency	Manufacturer
Short-acting		+	
Hydrocortisone acetate	25 mg/ml		Sovereign
Hydrocortistab	1 ml ampoules		
Intermediate-acting		+++++	
Methylprednisolone acetate	40 mg/ml		Pharmacia
Depo-Medrone	1 ml, 2 ml, 3 ml vials		
Depo-Medrone + Lidocaine	1 ml, 2 ml vials		
Triamcinolone acetonide			Squibb
Adcortyl	10 mg/ml 1 ml ampoules, 5 ml vials		
Kenalog	40 mg/ml 1 ml vials		

LOCAL ANAESTHETICS

These membrane-stabilizing drugs act by causing a reversible block to conduction along nerve fibres. The smaller nerve fibres are more sensitive, so that a differential block may occur where the small fibres carrying pain and autonomic impulses are blocked, sparing coarse touch and movement. Uptake into the systemic circulation is important for terminating their action and also for producing toxicity. Following most regional anaesthetic procedures, maximum arterial plasma concentrations of anaesthetic develop within 10–25 minutes, so careful surveillance for toxic effects is recommended for 30 minutes after injection if significant volumes are used.[37]

RATIONALE FOR USING LOCAL ANAESTHETICS

- ***Analgesic:*** although the effect is temporary, this may make the overall procedure less unpleasant for the patient, break the pain cycle (by reducing nociceptive input to the 'gate' in the dorsal horn), and increase the confidence of the patient in the clinician, the diagnosis and the treatment. In one study, pain inhibition was better with bupivacaine than lidocaine during the first 6 hours, presumably because of its longer half-life; in later evaluations no differences in outcomes were observed.[38] In another study, bupivacaine was superior to lidocaine at 2 weeks, but not at 3 and 12 months.[39] Some practitioners inject a mixture of short- and long-acting local anaesthetic in order to obtain both the immediate diagnostic effect plus more prolonged pain relief.
- ***Diagnostic:*** pain relief following an injection confirms the diagnosis and the correct placement of the solution.[10] Sometimes even the most experienced practitioner will be unsure exactly which tissue is at fault; in this situation a small amount of local anaesthetic may be injected into the most likely tissue and the patient re-examined after a few minutes. If the pain is relieved

then the source of the problem has been identified, and further treatment can be accurately directed.

- ***Dilution:*** the internal surface area of joints and bursae is surprisingly large, due to the highly convoluted synovial lining with its many villae, so an increased volume of the injected solution helps to spread the steroid around this surface.[10]
- ***Distension:*** a beneficial volume effect in joints and bursae may be the physical stretching of the capsule or bursa with disruption of adhesions.[40–43] Distension is not advised at entheses, so the smallest practicable volume should be used; distension in tendons by bolus injection of a relatively large volume of solution may physically disrupt the fibres and compress the relatively poor arterial supply, and also give rise to distension pain.

COMMONLY USED LOCAL ANAESTHETICS

Local anaesthetics vary widely in their potency, duration of action and toxicity.[37] Those most commonly used for joint and soft-tissue injection are:

- ***Lidocaine hydrochloride*** (previously lignocaine hydrochloride): the most widely used local anaesthetic, it acts more rapidly and is more stable than others. The effects occur within seconds and duration of block is about 30 minutes; this is the local anaesthetic recommended in this book.
- ***Marcain*** (bupivacaine) has a slow onset of action (about 30 minutes for full effect) but the duration of block is up to 8 hours. It is the principal drug for spinal anaesthesia in the UK. We do not use it for routine outpatient injections because the delayed onset of action precludes the immediate diagnostic effect available with lidocaine, and if there is an adverse effect this will take a long time to dissipate. There is no evidence of any long-term benefit from using bupivacaine instead of lidocaine.[39] Compared to placebo the effect of intra-articular bupivacaine wears off in less than 24 hours.[44]
- ***Prilocaine*** has low toxicity similar to lidocaine but is not as commonly used. ***Procaine*** is now also seldom used. It is as potent as lidocaine but with shorter duration of action.

Lidocaine (under the brand name Xylocaine) and Marcain are also manufactured with added adrenaline (which causes vasoconstriction when used for skin anaesthesia, and so prolongs the local anaesthetic effect). These preparations are not recommended for procedures involving the appendages because of the risk of ischaemic necrosis.[9] Xylocaine with adrenaline added is clearly marked in red. We recommend that clinicians who administer injection therapy avoid these combination products altogether.

POTENTIAL SIDE-EFFECTS

Side-effects from injection therapy with corticosteroids and/or local anaesthetics are uncommon and when they do occur are usually mild and transient.[45–47] Nonetheless it is incumbent upon the clinician practising injection therapy to

be aware of the presentation and management of all the potential minor and more serious side-effects associated with this treatment. (Table 1.3)[48]

Injection of the wrong drug is a potentially serious and totally avoidable problem with severe consequences for all concerned.[82] Strict attention to the preparation protocol should prevent this (Section 2).

Consider carefully before giving corticosteroid injections to pregnant or breastfeeding women; this therapy has been recommended for carpal tunnel syndrome and De Quervain's tendovaginitis in these patients[49,50] but these conditions usually resolve following delivery. If used, a detailed discussion of the pros and cons of injection therapy should be carefully documented.

LOCAL SIDE-EFFECTS

Local side-effects may occur when an injection is misdirected or too large a dose in too large a volume is injected too often. Subcutaneous placement of the steroid and the injection of a drug bolus at entheses must both be avoided. Serious local side-effects are rare.[45,126]

Post-injection flare of pain

The quoted figures are from about 2 % to 10 % [47,51] but this is well in excess of our own experience. When it does happen it is usually after a soft-tissue injection, and rarely follows a joint injection.[47] When corticosteroid is mixed with local anaesthetic the solution should be inspected carefully for flocculation/precipitation before injecting, as this may be related to post-injection flare of pain;[11] this may also be caused by the rapid intracellular ingestion of the microcrystalline steroid ester and must always be distinguished from sepsis.[52] There may be more frequent post-injection flares with methylprednisolone, but this may have more to do with the preservative in the drug than with the steroid itself.[53] An early increase in joint stiffness following intra-articular corticosteroids is consistent with a transient synovitis.[54]

Multi-dose bottles of lidocaine contain parabens as a preservative. Many steroids will precipitate when added to it and this precipitate may be responsible for some cases of post-injection flare of pain and 'steroid chalk' (see below). Parabens may also be responsible for some allergic reactions to local injections. The use of multi-dose bottles increases the risk of cross infection and should be avoided.[55] Single-dose vials of lidocaine do not contain parabens.

Subcutaneous atrophy and/or skin depigmentation[51,56]

In one meta-analysis of shoulder and elbow injections 'skin modification' had a frequency of 4 %.[51] Skin changes may be more likely to occur when superficial lesions are injected, especially in dark-skinned patients. The injected drugs should not be allowed to reflux back through the needle tract – pressure applied around the needle with cotton wool when withdrawing may help. In thin dark-skinned patients especially, it may be preferable to use hydrocortisone for superficial lesions. They must always be advised of the possibility of this side-effect, and the fact recorded. Local atrophy appears within 1–4 months after injection and characteristically proceeds to resolution 6–24 months later, but may take longer.[57] Fat atrophy following corticosteroid injection may rarely have significant functional consequences.[58,59]

- **Bleeding or bruising**

This may occur at the injection site, possibly more frequently in patients taking warfarin, aspirin, or oral NSAIDs with significant anti-platelet activity e.g. naproxen. It is important to apply firm pressure to the injection site immediately following needle withdrawal.

- **Steroid 'chalk' or 'paste'**

This may be found on the surface of previously injected tendons and joints during surgery. Suspension flocculation, resulting from the mixture of steroid with a local anaesthetic containing preservative, may be responsible. The clinical significance of these deposits is uncertain.[60]

- **Soft-tissue calcification**

Corticosteroid injections into osteoarthritic interphalangeal joints of the hand may result in calcification or joint fusion, possibly because of pericapsular leakage of steroids due to raised intra-articular pressure.[61] No deleterious effects have been ascribed to this calcification.

- **Steroid arthropathy**

A well known and much feared complication of local injection treatment – it is also largely a myth.[62] In many instances injected steroid may be chondro-protective rather than destructive.[20–28] There is good evidence linking prolonged high-dose *oral* steroid usage with osteonecrosis,[46] but almost all the reports linking injected steroids with accelerated non-septic joint destruction are anecdotal, and mainly relate to joints receiving huge numbers of injections.[62] A reasonable guide is to give injections into the major joints in the lower limbs at no less than 3–4 month intervals, although this advice is based on consensus rather than evidence.[9,65] Reports of Charcot-like accelerated joint destruction after steroid injection in human hip osteoarthritis may reflect the disease itself rather than the treatment.[61,64] Currently no evidence supports the promotion of disease progression by steroid injections.[65] Repeat injections into the knee every 3 months seem to be safe over 2 years.[65]

One study determined the relationship between frequent intra-articular steroid injection and subsequent joint replacement surgery in patients with rheumatoid arthritis who had received 4 or more injections in an asymmetric pattern in a single year. A subset of 13 patients with an average of 7.4 years of follow up was established as the cohort of a 5-year prospective study. This highly selected cohort received 1622 injections; joint replacement surgery was not significantly more common in the injected joints. The authors concluded that frequent intra-articular steroid injection does not greatly increase the risk inherent in continued disease activity for these patients and may offer some chondroprotection.[66]

- **Tendon rupture and atrophy**

The literature does not provide precise estimates for complication rates following the therapeutic use of injected or systemic steroids in the treatment of athletic injuries but tendon and fascial ruptures are reported complications of injection.[46] Tendon[67–69] and fascial rupture[70,71] or atrophy[72] is probably minimized by withdrawing the needle a little if an unusual amount of resistance is encountered,[67] and using a peppering technique at entheses with the smallest effective dose and volume of steroid.[73] The whole issue of steroid-associated tendon rupture is controversial,[68,69,71,74] disputed,[75] anecdotal,[46,67,76] and in humans not well supported in the literature,[69] although it is widely accepted that repeated injection of steroids into load-bearing tendons carries the risk of rupture.[77]

The current climate of opinion is antithetical towards steroid injection in to and around the Achilles tendon. If this is being contemplated it is advisable to image the tendon first to confirm that it is a peritendinitis with no degenerative change (with or without tears) in the body of the tendon. Low dose peritendinous steroid injections appear to be safe[78] and it might be safer to infiltrate with local anaesthetic alone. The patient should rest from provocative activity for 6–8 weeks.[68] In rabbits, injections of steroid, both within the tendon substance and into the retro-calcaneal bursa, adversely affect the biomechanical properties of Achilles tendons. Additionally, rabbit tendons that received bilateral injections demonstrated significantly worse biomechanical properties compared with unilaterally injected tendons. Bilateral injections should be avoided as they may have a systemic effect in conjunction with the local effect, further weakening the tendon.[79] Surgery for chronic Achilles tendonopathy has a complication rate of around 10% and should not be assumed to be a trouble free treatment option.[80]

Delayed soft tissue healing

This may be associated with local steroid injection. In a study of rabbit ligaments the tensile strength of the injected specimens returned to a value that was equal to that of the non-injected controls; however, the peak load of the injected specimens remained inferior, with a lag in histological maturation.[81] This has implications for the timing of return to activity following injection therapy.

Sepsis

Joint sepsis is the most feared complication of steroid injection treatment;[83] it may be lethal,[84] but it is a rarity.[45,85] Local infection occurs in only 1 in 17 000–162 000 patients when joint and soft tissue injections are performed as an 'office' procedure.[61,86,104] In one study local sepsis following injection of a pre-packaged corticosteroid in a sterile syringe was 1 in 162 000 injections compared with 1 in 21 000 using a non-prepackaged syringe.[86] Soft-tissue infections and osteomyelitis can also occur after local soft tissue injection.[87,88]

Prompt recognition of infection is essential to prevent joint and soft tissue destruction, although diagnosis may be delayed if symptoms are mistaken for a post-injection flare or exacerbation of the underlying arthropathy.[89]

Following an injection, swelling at the site, increased pain, fever, systemic upset (e.g. sweating, headaches) and severe pain on all attempted active and passive movements, should raise clinical suspicion of infection.

In the case of a patient who developed septic arthritis following a shoulder joint injection by her GP, the expert opinion was that infection is a rare hazard of the procedure, for which the GP should not be blamed, but that failure to recognize and appropriately manage this side-effect is difficult to defend.[48]

Fragments of skin may be carried into a joint on the tip of a needle and may be a source of infection.[90] Joint infections may also possibly occur by haematogenous spread, rather than by direct inoculation of organisms into the joint. Steroid injection may create a local focus of reduced immunity in a joint, thus rendering it more vulnerable to blood-borne spread. Rarely, injection of contaminated drugs or hormonal activation of a quiescent infection may be to blame. [83,89]

All cases of suspected infection following injection must be promptly admitted to hospital for diagnosis and treatment.[83] Blood tests (ESR, CRP, plasma viscosity, white blood cell differential count, blood cultures) should be taken along with diagnostic aspiration of the affected joint or any other localized swelling. The needle used for attempted aspiration may be sent for culture if

no aspirate is obtained.[87] X-ray changes may be absent in the early stages of joint infection and more sophisticated imaging techniques such as MRI and isotope bone scans may be helpful.

To avoid injecting an already infected joint have a high index of suspicion in rheumatoid patients,[91] elderly osteoarthritic patients with an acute monarthritic flare (especially hip) and patients with coexistent infection elsewhere, e.g. chest, urinary tract and skin, especially the legs. Visualize and dipstick the urine and check the ESR.[92]

In the largest series of bacterial isolates reported from UK patients with septic arthritis, the commonest organisms were *Staphylococcus aureus* and *Streptococci* species. Others were *E. coli*, *Haemophilus influenzae*, *Salmonella* species, *Pseudomonas* species and *Mycobacterium tuberculosis*.[93] *M. tuberculosis* may be particularly difficult to diagnose, and may require the study of synovial biopsy samples.[89] Infection was most common in children and the elderly. Underlying risk factors were reported in one fifth of cases, the most frequent being a prosthetic joint (11 %). Others included haematological malignancy, joint disease or connective tissue disorder, diabetes, oral steroid therapy, chemotherapy, presence of an intravenous line, intravenous drug abuse and post-arthroscopy.[93] Steroid injection may delay presentation of sepsis by 6–12 days.[94]

In one study, the incidence of septic arthritis increased over a 12-year period as more invasive procedures (arthroscopies and arthrocenteses) were performed on the study population, although the frequency of sepsis per procedure remained static, with sepsis after arthroscopy being almost four times as frequent.[95]

Joint infection has been reported as occurring between 4 days and 3 weeks after injection.[87] Exotic infections may occur in immunocompromised patients following joint injection.[96]

Aggressive therapy, including powerful immunosuppressive and cytotoxic drugs, is increasingly used in the treatment of rheumatoid arthritis, and may confer increased susceptibility to infections. Septic arthritis is one infectious complication known to be overrepresented in this disease; in one small series of these patients with septic arthritis, 6 out of 9 had received an intra-articular injection into the infected joint within 3 months prior to the onset of the sepsis. Only one of these occurred immediately after joint injection. The annual frequency of septic arthritis was approximately 0.2 %; during the 4-year period studied the frequency was 0.5 %. A frequency of 1 per 2000 injections was found when late septic arthritis was included. The high frequency of delayed septic arthritis in rheumatoid patients after intra-articular steroid administration should alert clinicians to this complication.[97]

Concern has been raised that prior steroid injection of the knee and hip may increase the risk of a subsequent joint infection following joint replacement[98,99] although this has been disputed.[100] Some surgeons deprecate the routine use of intra-articular steroids following knee arthroscopy because of a perceived increased risk of infection,[94] while others advocate this for post-procedural pain relief.[101,102]

If infection occurs following an injection, vigorous attempts must be made to isolate the causative organism. If this is *Staphylococcus aureus* the clinician should have nasal swabs taken and, if positive, should receive appropriate antibiotic treatment and not give any more injections until further swabs confirm clearance. A review of aseptic technique used should also be undertaken.[87]

Intra-articular corticosteroids may be effective following septic arthritis where pain and synovitis persist despite intravenous antibiotic treatment, and where lavage and repeat synovial fluid and blood cultures are sterile.[103]

Multidose bottles and vials should be avoided as they may become contaminated and act as a source of infection.[55] Drugs for injection must be stored in accordance with the manufacturer's instructions.

- **Rare local side-effects**

These include ***nerve damage*** (severe pain and 'electric shocks' if you needle a nerve), ***transient paresis*** of an extremity (from an inadvertent motor nerve block), and ***needle fracture***.[48,82]

SYSTEMIC SIDE-EFFECTS

Systemic complications are rare.[11]

- **Facial flushing**

This is probably the commonest systemic side-effect,[63] occurring in from 5 %[107] of patients to less than 1 %.[60] It may come on within 24–48 hours after the injection and may last 1–2 days.

- **Deterioration of diabetic glycaemic control**

Diabetic patients must be warned about this possible temporary side effect.[108] A common observation is that blood sugar levels undergo a modest rise for up to a week, rarely longer. Where larger doses of corticosteroid than recommended here for single site injection are given (or multiple sites are injected at one time, or over a few days), this may lead to a more prolonged (up to 3 weeks) elevation of blood sugar. This may require a short-term increase in diabetic drug dosage, so the patient should be informed about the steroid drug and dosage given. Systolic blood pressure may also be temporarily elevated by large doses of intra-articular corticosteroids.[109,110]

- **Uterine bleeding (pre- and post-menopausal)**

The exact mechanism is unknown but intra-articular steroid treatment causes a temporary, but considerable, suppression of sex steroid hormone secretion in women.[111,112] In a post-menopausal woman post-injection uterine bleeding creates a difficult dilemma – is the bleeding related to the injection, or should she be investigated to exclude other, potentially serious causes? If this complication occurs it must always be taken seriously.

- **Suppression of the hypothalamic–pituitary axis**

This occurs following intra-articular and intra-muscular injection of corticosteroids[113,114] but at the doses and frequencies described in this book this usually appears to be of no significant clinical consequence[53] and we do not issue patients with a steroid card after injection.[115] Rarely, however, systemic absorption of corticosteroid may evoke a secondary hypercortisolism similar to Cushing's syndrome. Patients who develop a Cushingoid state about 2 weeks after injection therapy (and their clinicians) often do not associate this with the corticosteroid injection, with the potential for the patient to undergo unnecessary investigation and treatment for a presumed primary endocrine disorder (Table 1.2). Screening the urine for corticosteroid drug metabolites helps with diagnosis. There may also be a transient eosinopenia on the differential blood white cell count.[128–130] Children may be particularly susceptible and display features of Cushing's syndrome following intra-articular corticosteroid injection.[118]

Clinical improvement of distant joints in a polyarthritis is an early clinical feature suggestive of significant systemic absorption of locally administered corticosteroid. In one study, triamcinolone hexacetonide plasma levels reached

Table 1.2 Suppression of the hypothalamic–pituitary axis by corticosteroid injection therapy[128]

Probably under-recognized	
May occur with single or multiple injections within minimum of 5 weeks	
Onset 10–14 days after injection	
Clinical features	
Moon face/buffalo hump	Acne-like eruptions/flushing
Palpitations/tremors	Dyspnoea/weight gain 5–8 kg
Disturbed menstruation	
Outcome	
Spontaneous resolution at 3 months (one injection) and 6 months (2 injections)	

their median serum peak 8 hours after injection into the rheumatoid knee.[116] This may account for the common observation of symptomatic improvement in joints other than the one injected. Higher serum levels of the injectate have been found in patients in whom the dose was divided into two joints rather than administering it into a single joint; a putative potentiation effect of divided doses has been attributed to a greater absorptive surface area in the divided-doses.[60] However, in one study comparing the treatment of rheumatoid arthritis with equivalent doses of intra-articular and intramuscular mini-pulse therapy with triamcinolone, less significant adrenocorticotropic hormone reduction was observed for the intra-articular group.[117]

Significant falls in the ESR and CRP levels

The mean fall is about 50 %. Intra-articular corticosteroid injections can cause this in patients with inflammatory arthritis and this effect can last for up to 6 months. This needs to be taken into account when using these blood tests to assess the response of patients to disease-modifying drugs.[119]

Anaphylaxis

Severe anaphylactic reactions to local anaesthetic injections are rare, but can be fatal.[120] Anaphylactic reactions to corticosteroid injections are extremely rare and are probably a reaction to the stabilizers that the drug is mixed with, rather than the drug itself.[53,121]

Other rare systemic side-effects

These include pancreatitis (patient presents with abdominal pain and the serum amylase is raised), nausea, dysphoria (emotional upset), acute psychosis, myopathy and posterior subcapsular cataracts.[48,122,123] Complex regional pain syndrome has been reported after trigger thumb injection.[124] In patients with sickle cell disease a crisis may be precipitated by intra-articular injection of corticosteroids; the mechanism is not clear, but it is suggested that this treatment be used with caution in these patients.[125] Tibial stress fractures and multifocal osteonecrosis have been reported with *systemic* but not locally injected corticosteroids used for athletic injuries.[46]

Despite all the above, injection therapy for joints and soft tissues is a relatively safe form of treatment. Adverse events can be minimized by ensuring that well trained practitioners follow appropriate procedures.[126]

In a large prospective study of 1147 injections, complications of injection therapy were recorded in just under 12 % of patients (7 % of injections), but almost all of these were transient. Only 4 patients (with tennis elbow) had subcutaneous atrophy but the steroid dose was 4 times the one we recommend. The commonest side effect was post-injection pain, but methylprednisolone was used which we

Table 1.3 Summary of potential side-effects of corticosteroid/local anaesthetic injection therapy

Systemic side-effects	Local side-effects
Facial flushing	Post-injection flare of pain
Impaired diabetic control	Skin depigmentation, fat atrophy
Menstrual irregularity	Bleeding/bruising
Hypothalamic–pituitary axis suppression	Steroid 'chalk', calcification
Fall in ESR/CRP	Steroid arthropathy
Anaphylaxis (very rare)	Tendon rupture/atrophy
	Joint/soft-tissue infection

believe may cause more pain than triamcinolone. Around 12 % of periarticular injections caused post-injection pain, but only 2 % of intra-articular injections were painful. Other side effects were bleeding and fainting or dizziness.

It is safe to mix corticosteroids with local anaesthetics prior to injection. High performance liquid chromatographic analysis to assess the stability of combinations of triamcinolone and hydrocortisone when mixed with combinations of lidocaine and bupivacaine shows that the combinations are stable when mixed together, supporting the continued use of these products in combination.[105]

Compared with the safety profile of oral non-steroidal anti-inflammatory drugs, the justification for using the minimum effective dose of injectable drugs in the correct place with appropriate preparation and aftercare becomes evident[106] (Table 1.4).

Table 1.4 Numbers needed to harm for patients >60 prescribed oral NSAIDs > 2 months

Number	Harm caused
1 in 5	Endoscopic ulcer
1 in 70	Symptomatic ulcer
1 in 150	Bleeding ulcer
1 in 1200	Death from bleeding ulcer

(from Tramer et al[106])

COSTS

The injectable corticosteroids and local anaesthetics that we use are remarkably inexpensive (UK prices, BNF March 2010) (Table 1.5). Compare this with the cost of some commonly prescribed oral NSAIDs and also with the cost of hyaluronan injections (on-line pharmacy prices August 2010).

Injection therapy may offer significant cost savings when compared with other treatment strategies for common musculoskeletal disorders.[127]

Table 1.5 The costs of some injectable drugs

Injectable drugs	
1 ml ampoule of Adcortyl (10 mg of triamcinolone acetonide)	£0.91
1 ml vial of Kenalog (40 mg)	£1.52
10 ml of 1% lidocaine	£0.39
Common oral NSAIDs	
Generic diclofenac – 1 month at 50 mg tds	£1.43
Generic ibuprofen – 1 month at 400 mg tds	£1.87
Generic naproxen – 1 month at 500 mg tds	£1.90
Hyaluronan injections	
Hyalgan (one syringe 20 mg/2 ml, 5 injections)	£48.10
Synvisc (one Hylan G-F20 syringe 24 mg/6 ml, 3 injections)	£266.50

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OTHER SUBSTANCES USED FOR INJECTION THERAPY

OVERVIEW

Since the 1930s an array of substances other than corticosteroids and local anaesthetics has been injected into joints and soft tissues, often with the aim of directly promoting tissue healing.

The first injectates, which yielded little benefit, were formalin, glycerin, lipodol, lactic acid, and petroleum jelly.[1,2] Many other agents have been tried since (Table 1.6). For soft tissue lesions in particular there has long been a clear need for effective conservative therapies, and in recent times novel agents have been injected specifically to try to promote healing. Depending on your perspective, these treatments exist either on the fringe or the frontier of musculoskeletal therapeutics.

Table 1.6 Some substances injected into joints/soft tissues for therapeutic effect

Adalimumab	Guanethidine	Phenol
Actovegin	Glycerin	Platelet rich plasma
Air	Hyaluronans & derivatives	Osmic acid
Anakinra	Infliximab	Radioactive materials
Aprotinin	Lactic acid	Sclerosing agents
Autologous whole blood	Lipodol	Traumeel®
Botulinum toxin A	Methotrexate	
Dextrose	Nonsteroidal anti-inflammatories	
Etanercept	Petroleum jelly	
Formalin	Polidocanol	

HYALURONANS

Endogenous (naturally occurring) hyaluronan (HA, previously known as hyaluronic acid) is a large, linear glycosaminoglycan and is a major non-structural component of both the synovial and cartilage extracellular matrix. It is also found in synovial fluid and is produced by the lining layer cells of the joint. These molecules produce a highly viscoelastic solution that is a viscous lubricant at low shear (during slow movement of the joint e.g. walking) and an elastic shock absorber at high shear (during rapid movement e.g. running). As well as conferring viscoelasticity the other key functions of HA in the joint are lubrication and the maintenance of tissue hydration and protein homeostasis through the prevention of large fluid movements by functioning as an osmotic buffer. HA is also considered a physiological factor in the trophic status of cartilage. HA has a very high water binding capacity; one gram dissolved in physiological saline occupies 3 litres of solution.[3,4]

In osteoarthritic joints the capacity of synovial fluid to lubricate and absorb shock is typically reduced. This is partly due to the production of abnormal HA with a reduction in the size and concentration of the molecules naturally present in the synovial fluid.[4]

Synthetic HA was isolated from roosters' combs and umbilical cord tissue and developed for clinical use in ophthalmic surgery and arthritis in the 1960s. The rationale for joint injection therapy was to replace the normal physiological properties lost to the osteoarthritic joint as a consequence of the associated reduction in the volume and quality of HA, a concept known as viscosupplementation. Commercial preparations of HA have the same structure as endogenous HA although cross-linked HA molecules (known as hylans) were later engineered by molecular linkage in order to obtain greater elastoviscosity and intra-articular dwell-time.[3]

Osteoarthritic knees may be treated by intra-articular injection of HA, usually after any effusion is drained.[3–6] The mode of action of exogenous (synthetic) HA and its derivatives is not clear, particularly when an effusion containing (endogenous) HA is removed and immediately replaced by (exogenous) HA which then stays in the joint cavity for only a few days at most. Perhaps these injections stimulate the synthesis of 'better quality' more physiologically normal endogenous HA and/or reduce inflammation.[4] Given the relatively short intra-articular residency, any hypothesis for the mechanism of action must account for the long duration of clinical efficacy that has been reported.[3]

A number of commercial preparations are available for injection (Table 1.7); there is no evidence that any one preparation is superior.[3] The licensed commercial formulations that have been available the longest in the UK are ***Hyalgan***® and ***Synvisc***®. Hyalgan has a lower molecular weight and is licensed as a medicinal *product*; it is injected once weekly for 5 weeks and is repeatable no more than 6-monthly. Synvisc has a higher molecular weight and is licensed as a medical *device*; it is injected once weekly for 3 weeks, repeatable once within 6 months, with at least 4 weeks between courses.

Table 1.7 Hyaluronan preparations available in the UK

Sodium hyaluronate	Hylan G-F20
Durolane®	Synvisc®
Euflexxa®	
Fermathron™	
Hyalgan® (not available for NHS prescription)	
Orthovisc®	
Ostenil®	
Suplasyn®	
Synocrom®	
Synopsis	

Research evidence on the efficacy of HAs is often difficult to interpret because of confounders, including: different molecular weights, different injection schedules (ranging from once to a series of five injections), and, despite large numbers of studies, generally poor trial design (lack of intention-to-treat analyses, and limitations in blinding).[6] Intra-articular HA injection for osteoarthritic knees is endorsed by two authoritative guidelines[7,8] but was rejected by the UK National Institute for Health and Clinical Excellence (NICE) on the grounds of cost.[3]

A recent systematic review and meta-analysis has concluded that from baseline to week 4, intra-articular corticosteroids appear to be relatively more effective for pain than intra-articular HA. By week 4, both therapies have equal efficacy, but beyond week 8, HA has greater efficacy. [9] A Cochrane review also suggests that the pain relief with HA therapy is achieved more slowly than with steroid injections, but the effect may be more prolonged.[6]

Two very recent 2010 prospective, double blind, randomized, placebo-controlled trials with large numbers of osteoarthritic knee patients have reached opposing conclusions. One study of 5 weekly injections of Hyalgan versus saline after one year showed no treatment effect in any outcome measure.[10] The other compared a single injection of Synvisc with placebo and after 6 months showed clinically relevant pain relief. No safety issues were seen in either study.[11]

Overall, the evidence suggests that HA and hylan derivatives are superior to placebo in terms of pain reduction, efficacy and quality of life outcomes in patients with osteoarthritic knees although the effect size is generally small. Given this, and the cost of these therapies, together with the increased number of clinician visits required, NICE concluded that the benefits of HA injection therapy would have to be three to five times higher than the current estimates before efficacy reached the standard threshold for cost effectiveness to the NHS. NICE also concluded that clinical trials do not suggest that there are sub-groups of patients who may have greater benefit from HA treatment (which might improve cost effectiveness).[3] Limited data are available concerning the effectiveness of multiple courses of HA therapy.[12] Patients older than 65 and those with the most advanced radiographic stage of osteoarthritis are less likely to benefit.[13]

Some commercial HAs are licensed for use in the hip joint. No significant differences between HA and placebo were reported by a trial evaluating efficacy and function outcomes in patients with hip osteoarthritis;[14] one systematic review noted methodological limitations in the literature, which were mainly the absence of a control group in most of the studies, overly short follow-up periods, and different ways of measuring outcomes. The review concluded that HA injection for hips should only be used under careful supervision and only in those cases where other treatments have failed.[15] A second systematic review concluded that despite the relatively low level of evidence of the included studies, HA injection performed under fluoroscopic or ultrasound guidance seems to be effective, and appears to be safe and well tolerated but cannot be recommended as standard therapy in the wider population.[16] A third review concluded that this therapy seems to be a valuable technique that may delay the need for surgical intervention, with no difference between products, but further studies are necessary.[17]

The use of HA injections in other joints is being investigated.[18–23] Encouraging, but inconclusive results have been observed for the treatment of shoulder, carpometacarpal, and ankle osteoarthritis.[24]

The toxicity of intra-articular HA appears to be negligible. No major safety issues have been identified when compared with placebo, but a definitive conclusion is precluded due to sample-size restrictions.[6] They may cause a short-term increase in knee inflammation.[25] A small percentage may experience a transient mild to moderate increase in pain following injection, and some have a flare with marked effusion. Local reactions to hylan GF-20 occur more often in patients who have received more than one course of treatment. Following corticosteroid injection these reactions abate without apparent sequelae.[26]

As with any injection procedure, there is a very small risk of infection.[3] The synergistic combination of corticosteroid and HA for simultaneous injection is an approach that has been investigated in a small number of studies.[27,28]

SCLEROSANTS (PROLOTHERAPY)

Sclerosing therapy was used by Hippocrates, in the form of cautery at the shoulder, to prevent recurrent dislocation. In current medical practice sclerosing agents are mainly injected to treat varicose veins, oesophageal varices and piles. This therapy has been used to treat chronic low back pain for over 60 years[29] and is also known as prolotherapy because it involves injecting a proliferant i.e. a substance that is intended to stimulate fibroblast proliferation.[30]

The musculoskeletal rationale for injection of sclerosants is to strengthen inadequate ligaments by exposing them to an irritant that will induce fibroblastic hyperplasia, seeking to stimulate connective tissue growth, and promote the formation of collagen.[29] The treatment aims to cause soft tissue inflammation, the opposite objective to corticosteroid injection therapy,[30] but the histological response may not be different from that caused by saline injections or needlestick procedures.[31] Prolotherapy for musculoskeletal disorders is not widespread but it seems to be popular with some patients; a survey of 908 primary care patients receiving opioids for chronic pain in the USA, most commonly chronic low back pain (38 %), reported that 8 % had used prolotherapy in their lifetime, and 6 % had used it in the previous year.[32]

Although this treatment is mostly used for back pain,[29,30,33–35] including the sacroiliac joint,[36] it has also been tried for peripheral instability[34,37] and in elite kicking-sport athletes with chronic groin pain from osteitis pubis and/or adductor tendinopathy.[38] *Intra-articular dextrose* sclerotherapy for anterior cruciate ligament laxity has also been reported in a small study.[39]

Prolotherapy has been investigated in Achilles tendinopathy. In a study comparing effectiveness and cost-effectiveness of eccentric loading exercises (ELE) with prolotherapy or combined treatment, at 12 months results were better for prolotherapy and for combined treatment, which had the lowest incremental cost compared with ELE, but long-term results were similar.[40] Sonography-guided *intratendinous* injection of 25 % hyperosmolar dextrose has also been used to treat chronic Achilles tendinopathy[41] and plantar fasciitis.[42]

The term 'prolotherapy' encompasses a variety of treatment approaches rather than a specific protocol, and that there are a large number of sclerosants.[35] One of the most common sclerosant solutions consists of a mixture of dextrose, glycerin, phenol and lidocaine (P2G).[35] Some use just dextrose and lidocaine, which may be potentially less neurotoxic, although part of the pain-relieving effect of sclerosant injection may be from a toxic action on nociceptors.

In the most carefully conducted study of prolotherapy for back pain reported so far, there was no difference between the effect of injecting a sclerosant solution or injecting saline at key spinal ligament entheses, but as both groups of patients improved significantly, it is difficult to decide what the particular effect of sclerosant injections might be.[43] A critical review concluded that prolotherapy may be effective at reducing spinal pain but great variation was

found in the protocols used, precluding definite conclusions. It was recommended that future research should focus on those solutions and protocols that are most commonly used in clinical practice, and that have been used in trials reporting effectiveness, to help determine which patients are most likely to benefit.[35]

A Cochrane review concluded that there is conflicting evidence regarding the efficacy of prolotherapy for chronic low-back pain, and that when used alone it is not an effective treatment. When combined with spinal manipulation, exercise and other co-interventions prolotherapy may improve chronic low-back pain and disability. Conclusions were confounded by clinical heterogeneity amongst studies and by the presence of co-interventions.[33]

The anecdotal experience of the authors is that this treatment may be worth utilizing in conditions where the symptoms are caused by chronic ligamentous laxity e.g. at the ankle, thumb or sacroiliac joint, or where other conservative interventions have failed.

POLIDOCANOL

Polidocanol (Ethoxysclerol) is a sclerosing local anaesthetic that has recently been injected to treat tendinopathies. The rationale for its use is that the pain from tendinopathy is related to the growth of new blood vessels (neovascularization) and their closely associated nerves. These vascular changes can be seen on colour Doppler ultrasound examination of tendons. In a pilot study polidocanol was injected under ultrasound control into the neovessels of patients with Achilles tendinopathy; 8 out of 10 subjects had significant reduction in their pain and returned to pain free tendon loading activities with benefit persisting at 6 months.[44]

A randomized controlled trial/cross-over study was conducted to investigate polidocanol in a group of elite athletes with patellar tendinopathy. The treatment group reported a significant improvement after 4 months; there was no change for the control group. After 8 months, when the control group had also received active treatment with polidocanol, they had a greater improvement than did the treatment group. There was no further improvement in either group at 12-month follow-up.[45]

Another prospective, randomized, controlled, double-blind, crossover trial compared guided intratendinous single injection of polidocanol with a single injection of local anaesthetic (lidocaine + epinephrine), in patients with tennis elbow. At the 3 month follow-up, additional injections with polidocanol were offered to both groups (crossover for group 2). At one year there was similar pain relief in both groups.[46]

In a retrospective study in which Achilles tendons received polidocanol injections for chronic midportion tendinopathy, pain correlated positively with neovessels on ultrasound. The authors concluded that their study did not confirm the postulated high beneficial value of sclerosing neovascularization injections in patients with this condition and stressed that polidocanol injection may not be as promising as was first thought.[47]

Larger, longer-term, double blind, randomized placebo-controlled trials of this approach are awaited. It would be especially useful to know how a 'blind' approach compares to injection using ultrasound guidance.

AUTOLOGOUS BLOOD

It is postulated that tendon healing and regeneration may be improved by injecting autologous growth factors (AGF) obtained from the patient's own blood[48] and there is growing interest in the working mechanisms. The amount and mixture of growth factors produced using different cell separating systems are largely unknown and it is also uncertain whether platelet activation prior to injection is necessary. AGF can be injected with autologous whole blood or platelet-rich plasma (PRP) and this therapy is increasingly used with high expectations of regenerative effects. Chronic tendinopathies including wrist extensors, flexors, Achilles tendons (and plantar fascia), have been treated with this approach.[49] PRP has also been injected into the knee to encourage the healing of cartilage.[50]

In a comparative, open study to evaluate the short-, medium-, and long-term effects of corticosteroid injection, AGF injection, and extracorporeal shock wave therapy in the treatment of tennis elbow, corticosteroid injection gave a high success rate in the short term. However, AGF and shock wave therapy gave better long-term results.[51] A review of treatments for tennis elbow concluded that there is strong pilot-level evidence supporting treatment with prolotherapy, polidocanol, AGF and platelet-rich plasma injection, but that rigorous studies of sufficient sample size are needed to determine long-term effectiveness and safety, and whether these techniques can play a definitive role.[52]

In a systematic review, all studies showed that injections of AGF (whole blood and PRP) in chronic tendinopathy had a significant impact on improving pain and/or function over time. However, only three studies using autologous whole blood had a high methodological quality assessment, and none showed any benefit when compared with a control group. The review concluded that there is strong evidence that the use of injections with autologous whole blood should *not* be recommended. There were no high-quality studies found on PRP treatment and therefore limited evidence to support its use in the management of chronic tendinopathy.[49]

In a subsequent recent double blind, randomized, placebo-controlled trial of eccentric exercises plus either PRP or saline injection for chronic midportion Achilles tendinopathy, PRP injection did not result in greater improvement in pain and activity.[53] Achilles tendinopathy in particular remains a frustratingly difficult therapeutic challenge.[55]

NICE guidance states that current evidence on the safety and efficacy of autologous blood injection for tendinopathy is inadequate and therefore this procedure should only be used with special arrangements for clinical governance, consent and audit, or for research. Clinicians wishing to undertake autologous blood injection for tendinopathy should take the following actions; inform the clinical governance leads in their Trusts; ensure that patients understand the uncertainty about the procedure's efficacy, especially in the long term, make patients aware of alternative treatments, and provide them with clear written information – use of NICE's information for patients ('Understanding NICE guidance') is recommended (available from www.nice.org.uk/IPG279publicinfo); audit and review clinical outcomes of all patients having autologous blood injection for tendinopathy.[54]

APROTININ

Aprotinin (Trasylol) is a natural serine proteinase inhibitor obtained from bovine lung. As a broad-spectrum matrix metalloprotease (MMP) inhibitor aprotinin is used to treat many conditions, but particularly to prevent blood loss during cardiac surgery; in chronic tendinopathy injection it may act as a collagenase inhibitor. Certain MMPs may be present in excessive proportions in patellar and rotator cuff tendinopathy, and it has been postulated that aprotinin could potentially normalize the concentration of MMPs in chronic tendinopathy, which might help healing. There have been many small, uncontrolled studies reporting high rates of success in the treatment of tendinopathy.

In a case review and follow up questionnaire for consecutive patients with tendinopathy treated by aprotinin injection, 76 % had improved, 22 % reported no change, and 2 % were worse, 64 % found the injections helpful, while 36 % had neither a positive nor negative effect. Achilles patients were more successfully treated than patella tendon patients.[56] In a prospective, randomized trial athletes with patella tendinopathy were injected with aprotinin, methyprednisolone or saline. At 12 months follow-up there were 72 % excellent or good responses in the aprotinin group, 59 % in the methylprednisolone group, and 28 % in the saline group, with respectively 7 %, 12 % and 25 % poor results.[57]

Another prospective, randomized, double blind, placebo-controlled trial comparing normal saline plus local anaesthetic injections and eccentric exercises, with aprotinin plus local anaesthetic injection and eccentric exercise demonstrated no significant benefit over placebo.[58]

Potential side-effects include allergy and anaphylaxis, although death has only been reported when used intravenously for cardiac surgery. Delay of 6 weeks between repeat aprotinin injections for tendinopathy reduces the risk of allergic reaction.[59] The 'test dose' of 3–5 ml for major procedures is similar to the therapeutic dose for tendinopathy. Injecting aprotinin for tendon injuries is currently an 'off-label' indication.

BOTULINUM TOXIN

Botulinum toxin injection is used to treat various painful conditions including muscle spasticity, dystonia, headache and myofascial pain. A systematic review to assess the evidence for efficacy of botulinum toxin A (BTA) compared with placebo for myofascial trigger point injection found five clinical trials that met the inclusion criteria. One trial concluded that BTA was effective, and four concluded that it was not. The review concluded that the data is limited and clinically heterogeneous and that the current evidence does not support the use of BTA injection in trigger points for myofascial pain.[60]

More recently there has been a randomized, placebo controlled, crossover trial examining the efficacy of botulinum toxin type A (BoNT-A) injection (Dysport®) to the distal vastus lateralis muscle, plus an exercise programme for chronic anterior knee pain (AKP) associated with quadriceps muscle imbalance. BoNT-A injection produced a greater reduction in pain and disability than placebo injection in carefully selected patients.[61]

ACTOVEGIN®

Actovegin® is a deproteinized hemodialysate of calf's blood postulated to improve cellular uptake and utilization of glucose and oxygen. It was initially licensed for intravenous use to improve tissue oxygen transport in patients with arterial disease. As a gel or cream it is also used to treat slow-healing skin lesions such as burns or skin-grafted wounds. In recent years it has gained notoriety for its use by elite cyclists as a performance-enhancing drug, with the consequence that the World Anti-Doping Agency (WADA) has banned its use in competition. Given the popularity of this treatment amongst professional athletes[62] there is a dearth of clinical trials. A Cochrane review of treatments for Achilles tendinopathy[63] concluded that, in the single small trial that compared Actovegin with a control injection, results were promising, but that the severity of patient symptoms was questionable.[64] A small study has reported short-term improvement and no adverse effects when Actovegin was injected into OA knees.[65] A pilot study of autologous blood injection for muscle strains used Actovegin plus Traumeel® as a control treatment and found the autologous blood to be superior.[66]

RADIO-SYNOVECTOMY

Radiosynovectomy (RSV, also known as radiosynoviorthesis) is the local intra-articular injection of radionuclides (beta particle emitters) in colloidal form for radiotherapy. First used in 1952 for medical synovectomy, the technique is for treatment of resistant synovitis of individual joints after failure of long-term systemic pharmacotherapy and intra-articular corticosteroid injections. RSV relieves pain and inflammation from rheumatoid arthritis, for which it initially was used, and is accepted as an alternative to surgical synovectomy in cases of this or other inflammatory joint diseases such as haemophiliac arthropathy. A systematic review and meta-analysis of the effectiveness of 169Erbium/186Rhenium-RSV (used predominantly in small joints) and 90Yttrium-RSV (used predominantly in knee joints) reported that success rates are high, but differences in effect with corticosteroid injection are less evident, although there is marked heterogeneity in the design of the small number of comparative studies. In comparison with surgical synovectomy, RSV produces equivalent results, costs less, allows the patient to remain ambulatory, and is repeatable. RSV has been proposed as the initial procedure of choice for the treatment of patients with haemarthrosis in haemophilia. In addition, local instillation of radiopharmaceuticals can effectively reduce effusions after implantation of a prosthesis.[67,68]

OTHER INJECTION TREATMENTS

New treatment modalities for arthropathy and tendinopathy, and novel potential pharmacological agents are currently being evaluated as joint and soft tissue injection therapies.[69–73]

A promising new idea is the use of high volume injections. In a preliminary study, athletes with resistant Achilles tendinopathy who failed to improve with an eccentric loading program were injected with 10 ml of 0.5 % bupivacaine hydrochloride,

25 mg of hydrocortisone acetate, and 40 ml normal saline solution under ultrasound guidance. There was a statistically significant difference between baseline and 3-week follow-up in all the outcome measures with improved symptoms, reduced neovascularization, and decreased maximal tendon thickness.[74]

Finally, it may be useful to bear in mind the thought that a 'promising treatment' is generally just the larval stage of a disappointing one.[75]

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LANDMARK AND IMAGE GUIDED INJECTIONS

OVERVIEW

The first decade of the new millenium has seen a great increase in the number of investigations into the accurate placement of musculoskeletal injections. A search on Pubmed (August 2010) using the term 'accuracy of intra-articular injection' revealed 17 studies from 1948–2000 and 92 from 2000–2010.

Most joint and tissue injections are facilitated via the visualization and palpation of anatomical landmarks to guide appropriate placement. A number of studies have reported on the accuracy of landmark guided joint and soft tissue injection techniques, and some have explored the relationship of the accuracy of these 'blind' (as opposed to image-guided) injections to clinical outcomes (Appendix 1).

CORRECT INJECTION PLACEMENT USING LANDMARKS

Experience

Surprisingly, the experience and seniority of the injector does not appear to influence the accuracy of injection placement[1–3]

Needle size

It is important to use a needle that is long enough, especially in obese patients, or the joint cavity may not be reached e.g. in the knee a 2-inch needle may sometimes be required rather than a standard 1.5 inch needle.[4]

Measured arthroscopically, the mean distance from skin surface to the subacromial bursa with anterior needle placement is 29 ± 6 mm (max. 35 mm/1.4 inches), with lateral needle placement 29 ±7 mm (max. 36 mm/1.4 inches) and with posterior needle placement 52 ± 11 mm (max. 63 mm/2.5 inches) in a group of patients with mean body mass index of 27.5. The distance to the subacromial bursa from the anterior and lateral approaches appears to be consistent and within reach of a standard 21G (green 40 mm) needle.[5]

Entry site and positioning

The choice of entry portal and positioning of a joint may affect accurate injection placement. In one study, injecting a dry knee in the extended position using a lateral midpatellar approach into the patellofemoral joint was intra-articular >90 % of the time and more accurate than injecting through the 'eyes' of the knee (anteromedial and anterolateral to the patellar tendon) with the knee in partial flexion.[4]

Pain on injection

'A painful injection is a misplaced injection' is a good rule of thumb. Once through the skin an injection should be painless unless the needle touches bone. When injecting hyaluronans (HA), the small amount of viscous fluid and the resistance to its flow may make it difficult to feel whether the solution is passing into peri-articular tissue or into the joint space. Pain during the injection, and increased pain afterwards, is associated with extra-articular needle placement and may be linked to a higher incidence of adverse reactions. Once the discomfort of needle placement has subsided, injection of HA should not be painful.[4]

Confirmation of needle placement

Needle placement may be confirmed when an effusion is present. During joint aspiration, the appearance of synovial fluid indicates intra-articular placement of the needle.[4] Remarkably, however, even the ability to aspirate fluid is not a perfect predictor of intra-articular placement of a subsequent injection.[1] In the absence of an effusion, needle placement requires the use of anatomical landmarks and tactile feedback to help the clinician position the needle. Minimal retraction of the needle after 'caressing' articular cartilage or bone with the needle tip may help to ensure intra-articular placement.[4]

Successful placement of an intra-articular knee injection may be confirmed by adding 1–2 ml of air to the injection. Immediately following the procedure, a 'squishing' sound is audible from the knee when it is passively moved through range. In one small study this simple test had a sensitivity of 85 % and a specificity of 100 %.[6] A similar test is described in the shoulder.[7] When the needle is correctly sited for a carpal tunnel injection, pulling back on the plunger causes a small bubble of air to be aspirated into the syringe (personal observation).

The backflow technique may be used to ascertain the accurate placement of the needle for intra-articular injections in patients with 'dry' OA knee i.e. a knee without any clinically detectable effusion. A small volume of normal saline is injected and re-aspirated, the premise being that successful re-aspiration indicates that the needle is in the joint. In one OA knee study observing backflow, the needle was correctly placed in 32 of 33 cases with it positioned outside the joint in the remaining case. Further studies should assess the technique for other joint injections.[8] It does not appear to be a reliable technique at the hip.[9]

For trigger finger injections the synovial space between tendon and sheath is narrow and often difficult to enter by direct injection; just prior to surgical release 72 patients had methylene blue injected percutaneously into the synovial sheaths of the finger. The dye was present within the sheath in only 49 % of cases.[10] To facilitate accurate injection the flexor tendons are palpated over the metacarpal head with the fingers extended. The patient is then asked to flex the fingers and the needle is inserted through the sheath and onto the tendon. The patient is then asked to extend the fingers. If the bevel of the needle has penetrated too far and has entered the tendon, it will slip out and remain in the synovial space as the tendon moves distally. Confirmation of synovial space placement occurs when there is no resistance to instillation. The technique may also be used for injection into the synovial space

surrounding the thumb (trigger thumb). In this case the space is entered at the midpoint of the proximal phalanx of the thumb on the volar surface. The needle is aimed at an oblique angle in a proximal direction with the thumb extended. The patient is asked to flex the thumb that pulls the tendon away from the needle end.[11]

The 'whoosh' test may confirm accurate needle placement in caudal epidurals; this involves listening for a 'whoosh' with a stethoscope placed over the sacrum while a small amount of air is injected prior to injecting drugs into the epidural space. In a small study of patients undergoing caudal epidural, 19/26 had correct needle placement as determined by epidurography. All these had a positive 'whoosh' test and there were no false positives.[12]

Post-injection

If local anaesthetic is part of the injection mixture, then re-testing post-injection should elicit a significant improvement in pain and physical signs, sometimes to the extent of temporary total abolition.

LANDMARK TECHNIQUE INJECTIONS

When expert clinicians deliver intra-articular injections, they normally do not need guidance from imaging techniques to place the needle successfully in the target area.[13] For most joint injections it is sufficient to follow an anatomical landmark.[14] Even the hip, a joint considered relatively inaccessible[14] may be successfully injected using anatomical landmarks,[15] although image guidance is often recommended.[9,16]

However, some studies report variable accuracy in placement of the needle in landmark guided intra-articular injections.[3,17,18] Placing the needle accurately in blind injections may be challenging in deep joints (e.g. hip or spinal joints). In addition, in conventional blind routes, the risk of incidental needling or drug delivery to the adjacent non-target structures, which may include blood vessels, peripheral nerves, muscles, ligaments, intratendinous tissue and subcutaneous fat, cannot be completely avoided[13]

CADAVER STUDIES

Landmark guided injection techniques have been studied in cadavers. Either dye is injected and then a dissection is performed, or radio-opaque material is injected and an X-ray is taken to assess how accurately the injectate has been placed. Conclusions from cadaveric studies must be interpreted with caution, as they may not be reproduced in a clinical setting.[19] Based on their findings from these cadaveric studies some authors have recommended image guidance under certain circumstances e.g. blind injecting may be too inaccurate in the acromioclavicular and finger joints, therefore correct positioning of the needle could be facilitated by fluoroscopy or musculoskeletal ultrasound (MSKUS) thereby guaranteeing an intra-articular injection[13] particularly in doubtful cases,[14] as unintended peri-articular injection may cause complications, and an unsuccessful aspiration can delay diagnosis.[20,21]

Optimized techniques might improve the accuracy and limit the use of blind injections in clinical situations, benefiting efficacy and safety.[22] Although

further clinical research is required, clinicians should consider imaging guidance to optimize injectate placement into areas when accuracy is necessary for diagnostic purposes, to assist in surgical decision-making or if the joint is abnormal.[23,24]

Choice of portals e.g. in knee injection (often cited as one of the technically easier techniques) might depend on the experience of the clinician, although 100 % accuracy cannot be obtained through any portal, which should be kept in mind when treating knee problems with intra-articular medications.[20]

CLINICAL STUDIES SUPPORTING THE ACCURACY OF LANDMARK GUIDED INJECTIONS

Some studies report accuracy of 80 % or greater for landmark guided joint and soft tissue injections at multiple sites[25] including the subacromial space, knee, and trapeziometacarpal joint (TMCJ).[4,8,26–29] Almost as good was the 78 % accuracy reported in one study that injected the hip from a lateral approach; when unsuccessful, the injected material was not found close to any neurovascular structures. This technique had an acceptable learning curve and, it was suggested, could be used safely in a standard office setting.[15]

In a subacromial injection study, the accuracy of 'blind' and musculoskeletal ultrasound (MSKUS) guided injection was the same; the fluid was injected blindly into the bursa in all cases as reliably as with MSKUS injection, and blind injection was recommended for use in routine daily use.[26] One study using real-time imaging with contrast material investigated landmark guided needle placement into the intra-articular space of the knee with no effusion. A lateral midpatellar injection into the patellofemoral joint was intra-articular 93 % of the time and was more accurate than injections performed by the same orthopaedic surgeon using two other portals. This study highlighted the need for clinicians to refine injection techniques.[4]

In a controlled, prospective, double blind study, landmark guided tendon sheath injection for de Quervain's tendovaginitis was more than 80 % accurate.[30] Landmark injections appear to be particularly accurate in patients with RA.[31,32] There was however, a 25 % soft-tissue extravasation rate for successful intra-articular injection in one study.[29] Some of these studies had very small numbers of subjects, so the results must be treated with caution.

CLINICAL STUDIES *NOT* SUPPORTING THE ACCURACY OF LANDMARK GUIDED INJECTIONS

The glenohumeral joint proved difficult to inject accurately using landmark guidance in 3 studies with success rates between 27–52 %.[2,7,19] In some studies, landmark guided injection of the subacromial space was also challenging with success rates between 27–70 %.[17,33,34] There is a 60 % potential for acromioclavicular joint (ACJ) injections to be out of the joint if performed by landmarks alone, and the routine use of image intensification guidance has been recommended for this injection.[35]

In another study of landmark guided trapeziometacarpal joint (TMCJ) injections, the needle was incorrectly placed, and its position had to be adjusted

in 42 % of cases using fluoroscopy to ensure correct intra-articular placement. Entering into an osteoarthritic TMCJ with a blind passage of the needle was not straightforward.[36]

In two studies the success rate of blind hip injections was 51–65 %. Obese patients, patients with severe grade 4 arthritis and no joint space, and those with flexion deformities were the majority of failed cases. The authors proposed that hip injections should be carried out by trained specialists under imaging guidance.[9,16] The trochanteric bursa was successfully injected only 45 % of the time in one study.[37] Again, some of these studies had very small numbers of subjects, so the results must be treated with caution.

IMAGE GUIDED INJECTIONS

Image guided injections have been in use for many years, especially techniques using X-ray guidance (fluoroscopy) for spinal injections. Other imaging methods including ultrasound (US), air and contrast X-ray arthrography, computed tomography (CT) and magnetic resonance imaging (MRI, using a vertically open MR unit) have also been used to guide needle placement.

In the last decade MSKUS, a safe, non-invasive, patient-friendly and readily repeatable form of imaging has been taken up widely, particularly in Europe, although elsewhere there has been less enthusiasm amongst clinicians who treat musculoskeletal disorders.[38] It has been enthusiastically advocated as a highly useful tool to guarantee accurate injection delivery and successful aspiration.[13,39,40]

ACCURACY

The gold standard for determining the accuracy of any injection technique is an immediate post-injection surgical dissection where the exact location of the injectate can be directly visualized.[10,15] The gold standard imaging test is contrast arthrography with X-rays or MRI. Studies to verify the accuracy of MSKUS using these techniques have been undertaken.[41] Innovative methodologies are continuously being developed, such as the GAS-graphy (glucocorticoid-air-saline mixture) method, as an alternative to the radiographic contrast medium method in verifying successful landmark intra-articular injections.[25] The feasibility and accuracy of MSKUS has been shown for many locomotor regions including the subacromial bursa,[33] radiocarpal joint, [42] the carpal tunnel,[43] trigger finger,[44] hip,[45,46] knee,[47] Achilles and patellar tendons,[48] and the foot and ankle.[49]

However, rheumatologists remain divided on whether they should introduce musculoskeletal US into their clinical practice. [50]

THE CASE FOR

There is accumulating evidence that MSKUS improves clinical diagnosis and intervention skills. High-resolution US is superior to clinical examination in the diagnosis and localization of joint and bursal effusion and synovitis. MSKUS is the imaging modality of choice for the diagnosis of tendon pathology. It is seven times more sensitive than plain radiography in the detection of

rheumatoid erosions, allowing earlier diagnosis of progressive rheumatoid arthritis (RA). Ligament, muscle, peripheral nerve and cartilage pathology can also be readily demonstrated by MSKUS. There is evidence that it may potentially be used by rheumatologists to non-invasively diagnose and monitor not just joint and muscle disease but also nerve compression syndromes, scleroderma, vasculitis and Sjögren's syndrome.

Joint aspiration and injection accuracy can be improved by MSKUS, with initial evidence confirming improved efficacy.[51,52] As the number of doctors performing MSKUS increases and technical skills improve, there is likely to be a growing number of proven clinical indications for its use in rheumatology practice.[50] MSKUS injections may offer a useful alternative in difficult cases, such as patients with changed anatomy postoperatively, or when there is no effective clinical outcome of a blind injection.[53]

THE CASE AGAINST

Although MSKUS is a flexible and promising imaging modality for the future, and is likely to become a routine part of musculoskeletal clinical management, its introduction remains controversial, reflecting the relative infancy of the area. Problems to overcome include the significant investment in time and money required to set up a service, the lack of both a formal training structure and of outcome data.[54] A central issue in clinical practice is the need for proof of clinical relevance and improved patient care.

There is a significant learning curve and time commitment for the acquisition of MSKUS skills that are also highly operator dependant with moderate to good interobserver reliability.[55] In particular, guided injections of deep anatomical targets require more experience than superficial injections. The oblique direction of the needle to the ultrasound beam in deep injections decreases its visibility during these procedures.[13]

Further consensus on standardization of scanning techniques and diagnostic criteria is necessary to improve the consistency of MSKUS.[56] There is also a tendency in the current literature to emphasize the positives and highlight marginal benefits and not to delve too deeply into the duration of any benefits or issues related to cost-effectiveness.

IMAGE GUIDANCE AND CLINICAL OUTCOMES

The key question is whether guided injections, irrespective of greater potential for accuracy, produce a significantly different clinical outcome from those using anatomical landmarks.[14] There are few prospective randomized controlled trials investigating this issue.

STUDIES THAT CORRELATE EFFECTIVENESS WITH ACCURACY

All of these studies used some form of imaging to determine the placement of the injectate. In one study 148 painful joints were randomized to injection by conventional landmark guidance or MSKUS enhanced with a one-handed control syringe (the reciprocating device). Relative to conventional blind methods, MSKUS resulted in a reduction in procedural pain and absolute pain scores at

2 weeks. It also increased detection of effusion by 200 % and volume of aspirated fluid by 337 % and, the authors concluded, significantly improved clinical performance and outcomes of outpatient injections compared with conventional landmark guidance.[39] A small number of shoulder studies have indicated that image guided intra-articular injections may offer advantages over blind techniques for adhesive capsulitis and may deliver benefits during the first few weeks of treatment, suggesting that the improved intraarticular targeting by using MSKUS may result in better results.[57]

In one study of subacromial impingement, 2 weeks after treatment, failure to obtain an accurate placement was associated with return to pretreatment assessment values, while significant improvement continued in patients accurately injected.[27] In another, at 2 weeks post-injection of the subacromial space and glenohumeral joint, there were significant positive outcome differences between the accurately placed and inaccurately placed groups.[17] In another shoulder study, there was significantly greater improvement at 6 weeks with MSKUS versus landmark guidance. The authors suggest that MSKUS injections are indicated, at least, in patients with a poor response to previous blind injection to ensure accurate placement.[58]

Another study compared joint and soft tissue aspiration between conventional landmark technique and MSKUS guided technique. In the landmark group, 32 joints in 30 consecutive patients were aspirated by an experienced rheumatologist; in the image guided group, 31 consecutive patients were examined by MSKUS to confirm the presence and location of fluid. Following this examination, aspiration was performed by a second rheumatologist based on the MSKUS localization, or under direct MSKUS guidance. Its use to localize fluid collection greatly improved the rate of diagnostic synovial fluid aspiration, particularly in small joints, with important implications for accurate administration of local steroid therapy, highlighting the importance of MSKUS as a useful tool in clinical rheumatological practice.[51]

STUDIES THAT *DO NOT* CORRELATE EFFECTIVENESS WITH ACCURACY

In a study of RA patients, clinicians who used MSKUS guidance reliably assessed the accuracy of joint injection whereas those who used landmark guidance did not. One third of landmark guided injections were inaccurate, but there was no significant difference in clinical outcome between the group receiving MSKUS and those receiving landmark guided injections. MSKUS guidance significantly improved the accuracy of joint injection, allowing a trainee to rapidly achieve higher accuracy than more experienced rheumatologists, but did not improve the short-term outcome of joint injection.[31]

In a study of blind glenohumeral injections about half were not intracapsular. Improvements in all subjects for pain and self-reported function at 4 weeks post-injection occurred irrespective of accuracy, even with wide variance in duration of symptoms, multiple injectors with varied training, a blinded approach to injection and multiple injection approaches. Accuracy did not appear to depend on the experience of the physician and the authors suggested that experience might be irrelevant in treating shoulder pain of multiple origins.[2]

In another study, the accuracy of subacromial injection was 70 %. There was significant improvement in shoulder function and pain level at 3 months

post-injection, but clinical improvement did not correlate with accuracy, although accurate injections did reliably produce a positive impingement test.[34] CT control guided and landmark approaches to performing suprascapular nerve blocks result in similar significant and prolonged reductions in pain and disability; both approaches are safe.[59]

During trochanteric bursa injections one group of investigators found that radiological confirmation of bursal spread is necessary to ensure that the injectate reaches the area of pathology,[60] but subsequently the same group also found that this does not improve outcomes compared to blind injection. They also noted that fluoroscopic guidance dramatically increases treatment costs for greater trochanteric pain syndrome.[37]

MSKUS guided injection is effective in the management of plantar fasciitis, but is not more effective than landmark guided injection. It may be used as an objective measure of response to treatment in plantar fasciitis.[61,62] In another study MSKUS guided, palpation guided, and scintigraphy guided injections were equally effective in the conservative treatment of plantar fasciitis at 25 months post-injection.[63]

US guided injections were performed in 20 sacroiliac joints (SIJ) of 14 consecutive patients suffering from active sacroiliitis. Immediately following injection, MRI scanning was performed to verify correct placement. Only eight injections (40 %) were exactly positioned into the SIJ space, whereas the other 12 (60 %) missed it. However, there were no significant differences in outcome between the accurately injected group and the peri-articularly injected group. Similar pain relief was observed in both groups. 24 hours and 28 days after the intervention. These results demonstrate that intra-articular SIJ injections remain technically challenging despite US guidance and that peri-articular deposition of triamcinolone appears sufficient for pain and symptom control in patients suffering from active sacroiliitis.[41]

Carpal tunnel syndrome responds to injections deliberately given proximal to the tunnel.[64] In one de Quervains's study there were better outcomes associated with more accurate injections,[30] but good outcomes in another study when the injection was deliberately placed outside the tendon sheath.[65]

Unexpectedly, one study indicated better results for trigger finger with injections outside the sheath; ninety-five patients with 107 trigger digits were divided into 2 groups and studied prospectively to evaluate steroid injection placement and efficacy. In one group, an attempt was made to inject into the tendon sheath at the A1 pulley; in the other, one injection infiltrated the subcutaneous tissues overlying the A1 pulley. Radioopaque dye was added to the injection medium, and post-injection X-rays identified the true delivery site. Of the 52 digits into which intra-sheath injection was attempted, 19 digits (37 %) received all the injection within the sheath, 24 (46 %) into both the sheath and the subcutaneous tissues, and 9 (17 %) received none within the sheath. The results were analysed to determine whether injection placement influences the efficacy of steroid injection. The confirmed all-sheath injection group exhibited a 47 % good response, the mixed sheath and subcutaneous group a 50 % good response, and the all-subcutaneous group a 70 % good response. This suggests that true intra-sheath injection offers no advantage over subcutaneous injection in the treatment of trigger digits.[66]

WHY MIGHT CLOSE ENOUGH BE GOOD ENOUGH?

In some instances then, a good therapeutic response may be experienced when an attempted joint or tendon sheath injection is peri-articular or peri-tendinous, suggesting that total accuracy of needle placement may not be essential to a satisfactory outcome.[1,29,66]

The effect of accurate needle placement, or otherwise, on a therapeutic response to local corticosteroid injection needs further elucidation.[41] Various explanations have been mooted, and the mechanism of local corticosteroid action is not well understood. Both a systemic effect and a local action by diffusion of the steroid suspension, either into blood vessels or the surrounding anatomical structures, could explain the therapeutic effect, even when the injection does not reach the target tissue.

Systemic corticosteroid administration is certainly effective for some focal musculoskeletal conditions. Oral prednisolone 30 mg daily for 3 weeks is superior to placebo for improving pain, function, and range of motion in adhesive capsulitis with significant short term benefits, although these are not maintained beyond 6 weeks.[67] In an intriguing recent study no important differences in short-term outcomes were found between local MSKUS corticosteroid injection and systemic injection in rotator cuff disease.[68,69] Injecting one joint and finding that other distant joints significantly improve is a phenomenon familiar to all regular injectors.

It is plausible therefore that precise deposition of a musculoskeletal injection is not always required. If so, we do not yet know in which circumstances absolute precision is critical.

THE FUTURE FOR LANDMARK GUIDED INJECTIONS

For most, if not all disorders treated by musculoskeletal injection, the optimum landmark guided technique has yet to be firmly established. The approaches described in this book are based on the clinical experience of the authors and on techniques described in the medical literature. Further studies are needed to verify reproducible and accurate methods of therapeutic delivery into joint and soft tissue lesions without the need for imaging confirmation. Novel approaches should be welcomed and vigorously evaluated.[64,70,71]

There is a need to develop evidence based criteria for the selection of patients best suited to an image guided injection (Table 1.8). The explicit

Table 1.8 When image guidance may be particularly useful

- When diagnosis remains secure but landmark-guided injection/aspiration has failed
- When purpose is primarily diagnostic, rather than therapeutic, e.g. surgical planning
- Very obese patients
- Highly anatomically abnormal joints
- Spinal injections
- When training clinicians to inject
- Verify correct placement in research studies[75]
- When monitoring effect of injection therapy[76–81]

creation of anatomically accurate schematics of musculoskeletal anatomy that highlight superficial and deep landmarks and sources of potential complications relevant to needle procedures should allow for safer and more accurate non-image-guided needle procedures.[72] Studies could be conducted on the accuracy of needle placement in OA patients with the results categorized by radiographic severity, as the approach may need to be modified according to the joint state.[28] The utility and potential of MSKUS as a training tool to optimize landmark guided injections also needs to be fully explored and exploited.

It remains for proponents of imaging guided injections to demonstrate that this approach does more than improve short term outcomes, and makes a real difference over the longer term sufficient to justify the extra cost.[14,37] MSKUS guidance can maximize injection accuracy in the intended target area and minimize adverse effects, but benefits are seen only over 2–6 weeks. There is a tendency in the current literature to emphasize the positives in MSKUS guided techniques and not consider the length of the therapeutic effects or their cost-effectiveness.

The hypothesis that precise location is always necessary for successful injection therapy is also one that needs to be tested. Until there is sufficient evidence from both participant and outcome assessor blinded randomized trials documenting a real difference between image guided needle placement and the anatomical landmark approach over the longer term (sufficient to justify the extra cost), the requirement for precise localization remains speculative.[38] Image guided injection should be reserved for specific indications (Table 1.8).[14,53,58] These indications are currently based on expert opinion. For example, there is, as yet, no prospective trial in which patients who have failed a 'blind' injection have been randomized to either a further blind or image guided injection so this approach, as with most of the others, is not currently evidence based.

Before the use of image guided techniques come to be seen as superior or even mandatory we need to be certain that the potential for landmark techniques has been fully exploited and optimized, and that the superiority of MSKUS in daily clinical practice, particularly its cost-effectiveness, has been firmly established. We must resist replacing a relatively straightforward, inexpensive non-standardized approach with an equally non-standardized complex and expensive one. Novel treatments, especially those involving high technology are seductive.[73] Before clinicians invest their money in hardware, and their time and money in training and the acquisition and maintenance of a new skill, they need to be sure that they have not fallen for the lure of technology, and that the emperor is actually wearing some clothes. Physicians are also, at times, driven to use the newest technology and perform many diagnostic tests, for fear of litigation. This practice is often independent of the best evidence we need in order to provide cost-effective treatments.[74]

Therefore, until we have good evidence that image guided injections in routine therapeutic practice are both more clinically effective and cost effective, it seems reasonable to conclude that most injections can be given using an anatomical landmark approach.

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ASPIRATION AND MISCELLANEOUS INJECTIONS

A number of conditions may be associated with a joint effusion. Fluid may also accumulate in bursae and synovial sheaths. If fluid is present then aspiration (arthrocentesis) is useful both diagnostically and therapeutically (Table 1.9).[1] Aspiration may be particularly helpful in reaching a diagnosis when a patient presents with an acutely hot, red, swollen joint. An effusion in a joint is known to result in loss of muscle strength (arthrogenic muscle inhibition), so rehabilitation is unlikely to be successful unless any effusion is suppressed.[2–4]

In rheumatoid knees aspiration of synovial fluid prior to steroid injection significantly reduces the risk of relapse.[5] The effect of an injection in inflammatory arthritis may be prolonged by 24 hours' bed rest immediately after the procedure,[6,7] but the benefit of this in osteoarthritis is less certain. There is controversy as to whether the presence of an effusion in osteoarthritic knees predicts a better response to joint injection than if the knee is dry.[8,9]

Table 1.9 Italian Society of Rheumatology Arthrocentesis Guidelines 2007[10] (several of these recommendations were based on expert opinion rather than on published evidence)

- Indicated when synovial effusion of unknown origin is present, especially if septic or crystal arthritis is suspected
- The patient should be clearly informed of the benefits and risks of the procedure in order to give informed consent
- Fluid evacuation often has a therapeutic effect and facilitates the success of the following intra-articular injection
- Careful skin disinfection and the use of sterile, disposable material is mandatory for avoiding septic complications
- Disposable, non sterile gloves should always be used by the operator, mainly for their own protection.
- Contraindications are the presence of skin lesions or infections in the area of the puncture
- Anticoagulant treatment is not a contraindication, providing the therapeutic range is not exceeded
- Joint rest after arthrocentesis is not indicated
- Ultrasonography should be used to facilitate arthrocenteses in difficult joints

ASPIRATION

EQUIPMENT

Joint fluid may be loculated, very viscous and contain debris, all of which may prevent complete aspiration. With a small-bore needle it may be impossible to aspirate anything, so use at least a 21G or even a 19G needle. Disposable gloves are recommended to protect the clinician[11] and absorbent towels to protect the treatment area.

A 3-way connector between needle and syringe is useful to prevent having to disconnect the syringe if it is full but there is still further fluid to aspirate. If this

happens, the joint fluid tends to drip out of the disconnected needle (hence the need for absorbent towels to catch the drips), so another syringe should be ready to connect immediately. If the needle is left in the joint and the syringe is disconnected, the pressure between the inside and outside of the joint will equalize which may make aspiration more difficult.

A novel double-barreled one-handed reciprocating procedure syringe has been compared with a conventional syringe for aspiration and injection in a randomized trial. The reciprocating syringe prevented significant pain, reduced procedure time, and improved physician performance of arthrocentesis. We await a cost-effectiveness analysis.[12] (See demonstration at www.youtube.com/watch?v=wrcedExWgJE)

TECHNIQUE

Using a landmark technique, once the needle is thought to be positioned within the fluid, hold the barrel of the syringe with the index finger and thumb of the non-dominant hand while bracing the back of the same hand against the patient. This helps to maintain the needle position while gently pulling on the plunger of the syringe with the dominant hand. Moving the tip of the needle a few millimetres, or rotating it through 90° may improve the flow into the syringe. In the knee it may be helpful, while maintaining position with the braced non-dominant hand, to use the other hand to massage fluid towards the needle.

Emptying a large effusion may require more than one syringe. Increasing syringe size is associated with the undesirable characteristic of loss of control of the needle in the forward or reverse direction. Two-handed operation of a syringe results in greater control than one-handed.[13]

CLINICAL ASSESSMENT OF THE ASPIRATE

After aspiration the fluid should be immediately examined for **colour, clarity** and **viscosity**.

The clinical context will usually accurately predict the nature of the aspirate. The gross appearance of the fluid can provide a quick bedside orientation about the amount of inflammation present. Totally transparent serous fluid (Fig. 1.3A) originates in non-inflammatory conditions, of which osteoarthritis is the most common, and the amount of turbidity grossly relates to the amount of inflammation.[14]

LABORATORY ASSESSMENT OF THE ASPIRATE

Ideally, any aspirate should be examined in the laboratory within four hours of aspiration. If analysis is delayed there will be a decrease in cell count, crystal dissolution, and artefacts will start to appear. Storage at 4°C will delay but not prevent these changes. The requirement for all aspirates to be sent for microscopy and culture to exclude crystal arthritis[15] and infection has been challenged.[16]

An estimated third of rheumatologists routinely send aspirated synovial fluid samples for culture irrespective of the underlying diagnosis. This is done even when sepsis is not suspected. A review of 507 synovial fluid culture requests revealed that positive bacterial growth was rare even when sepsis was queried on the request forms, but none was positive in any of the routine samples, throwing doubt on the value of routine synovial fluid culture. One recommended

policy is that such cultures are undertaken only when infection is a possibility and in immunocompromised patients. This approach would be very cost-effective. Clinicians need to develop local policies in consultation with their colleagues.[17]

Although many laboratory tests may be performed on synovial fluid, only the white blood cell count (and percentage of polymorphonuclear lymphocytes), presence or absence of crystals, Gram stain, and bacterial culture are helpful.[16,18] A critical appraisal of the relevant literature concluded that given the importance of synovial fluid tests, rationalization of their use, together with improved quality control, should be immediate priorities. Further investigation was recommended into the contribution of synovial fluid inspection and white cell counts to diagnosis, as well as of the specificity and sensitivity of synovial fluid microbiological assays, crystal identification, and cytology.[18]

The white cell count offers quantitative information, but the boundaries between non-inflammatory and inflammatory synovial fluid, and between this and septic fluid, are very hazy and figures have to be interpreted in the clinical setting.[14] The percentage of polymorph leucocytes in synovial fluid aspirated from rheumatoid knees may have a modest predictive value for the medium term effectiveness of subsequent intra-articular steroid injection.[19]

DIAGNOSIS OF SEPSIS

Synovial fluid analysis is of major diagnostic value in acute arthritis when septic arthritis is suspected.[17] Direct microscopy with Gram staining is performed on the fluid as soon as possible. To exclude TB, Ziehl–Nielsen (Z–N) staining must be specifically requested. Prolonged culture, usually 6 weeks, may be necessary. TB is more common in immunosuppressed patients, recent immigrants, Asians and alcoholics. Special cultures are also needed if fungal infection is suspected.

Inoculation of the aspirate from joints and bursae into liquid media bottles increases the sensitivity in the detection of sepsis.[20,21]

Staphylococcus aureus is the commonest organism in cases of septic arthritis (page 20). A systematic review has identified features associated with septic arthritis (Table 1.10).[22]

Table 1.10 Predictive features for diagnosis of non-gonococcal bacterial arthritis[22]

Risk factors (significantly increase the probability of septic arthritis)
Age
Diabetes mellitus
Rheumatoid arthritis
Joint surgery
Hip or knee prosthesis
Skin infection
Human immunodeficiency virus typ. 1 infection
Clinical features
Joint pain (sensitivity 85%)
Swelling (sensitivity 78%)
Fever (sensitivity 57%)
The 3 features above are the only findings in more than 50% of patients
Sweats (sensitivity 27%)
Rigors (sensitivity 19%)
The 2 features above are less common findings in septic arthritis

Based on data from 14 studies involving 6242 patients

DIAGNOSIS OF CRYSTAL ARTHROPATHY

Synovial fluid analysis is of major diagnostic value in acute arthritis when crystal arthropathy is suspected.[18] Detection of monosodium urate (MSU) and calcium pyrophosphate dihydrate (CPPD) crystals in synovial fluid, even from un-inflamed joints during intercritical periods, allows a precise diagnosis of gout and of calcium pyrophosphate crystal-related arthritis (pseudogout).[1]

The identification of crystals in synovial fluids and joint tissues is the most rapid and accurate method of diagnosing the common forms of crystal-associated arthritis. Although there are numerous methods available for identifying and characterizing crystals in biological specimens, in practice, polarizing light microscopy is used almost exclusively for articular crystals. Unfortunately, problems with reliability and reproducibility undercut the usefulness of this simple procedure.[23] When examined under polarized microscopy MSU crystals are negatively birefringent. CPPD crystals are positively birefringent but only one in five CPPD crystals have sufficient birefringence for easy detection and they are easily missed if searched for only using a polarized microscope.[14] For trained observers, the detection and identification of crystals in synovial fluid is a consistent procedure.[24]

IMAGE GUIDED ASPIRATION

In small joints that are difficult to aspirate ultrasound guidance may improve the accuracy and frequency of joint aspiration (page 48). It may also help reveal the presence of synovial fluid before aspiration and, subsequently, distinguish some aspects characteristic of crystal-induced arthropathies.[25]

WHAT THE ASPIRATE MIGHT BE AND WHAT TO DO

Should you aspirate and inject at the same time, or await the result of joint fluid analysis? This depends on the clinical context, the appearance of the fluid, and the experience of the clinician. ***If in doubt, do not inject.***

- **Serous fluid of variable viscosity:** normal or non-inflammatory synovial fluid is a viscous, colourless or pale yellow (straw-coloured) substance normally present in small amounts in joints, bursae, and tendon sheaths (Figure 1.1). It has mechanical and physiological functions (page 31). It contains few cells (mainly mononuclear) and little debris and therefore appears clear. It does not clot and is very viscous due to its high hyaluronan content. The 'drip test' forms a string 2–5 cm long before separating when a small amount of fluid is gently expelled from the end of a horizontal syringe. Greatly increased viscosity may be due to a recent steroid injection into that joint or hypothyroidism.
- **Frank blood:** usually there is a history of recent trauma with the joint or bursa swelling up rapidly afterwards. Aspiration gives pain relief, allows joint movement, and removes an irritant that causes synovitis. Blood often means a significant traumatic lesion so an X-ray is mandatory. Haemarthrosis of the knee is due to anterior cruciate ligament rupture in up to 40 % of cases (Figure 1.2A).

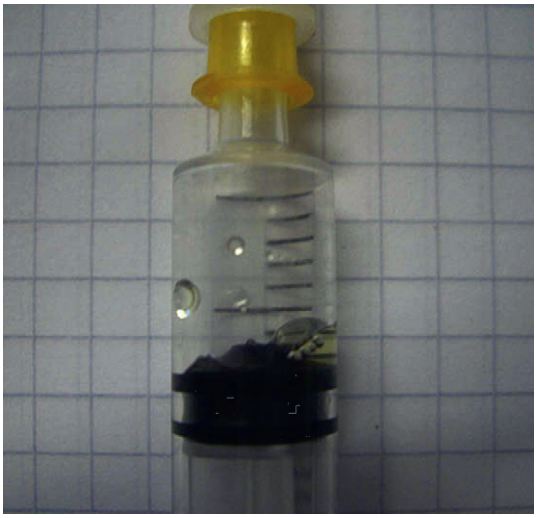

Figure 1.1 Synovial fluid aspirated from a normal knee – small volume of clear, slightly yellow, highly viscous fluid. (Courtney, Doherty, 2009, with permission.)

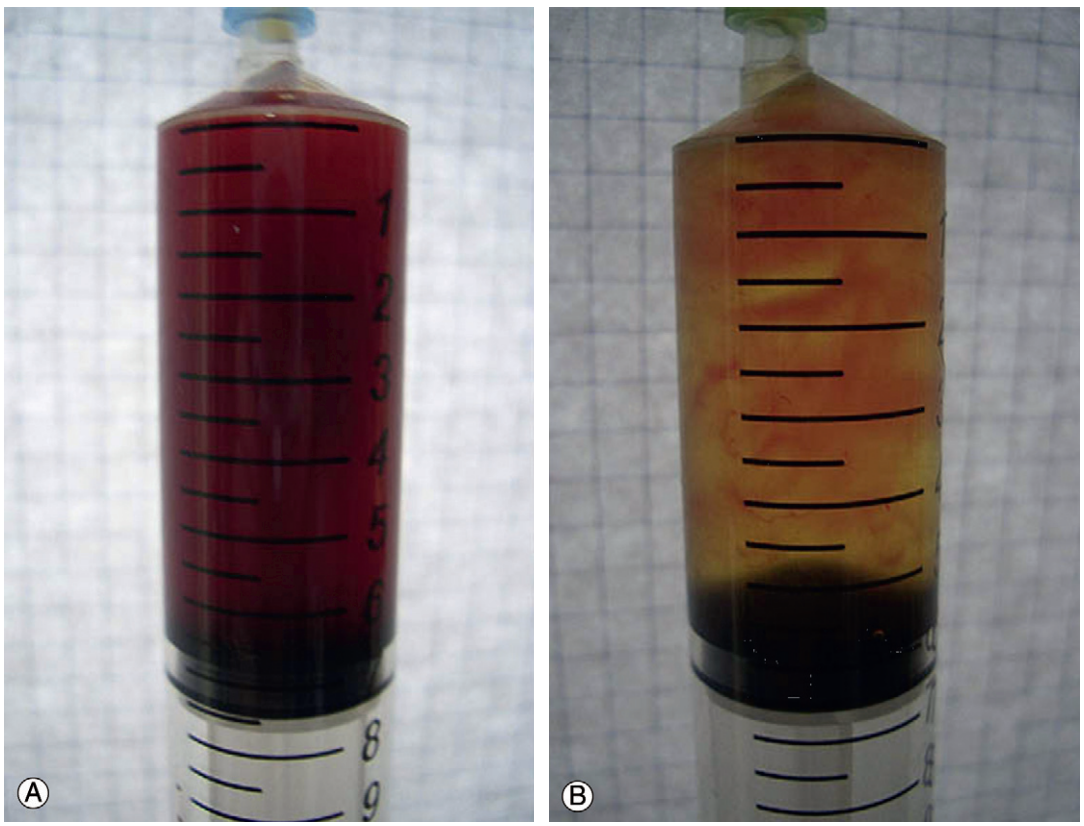

Figure 1.2 **A** Haemarthrosis and **B** blood-tinged snyovial fluid, reflecting trauma at the time of needle insertion (Courtney, Doherty, 2009, with permission.)

If there is a lipid layer on top of the blood this suggests intra-articular fracture. It is thought to be inadvisable to inject into an aspirated bleeding joint as there may not be a lesion that will respond, and injection may encourage further bleeding. There may also be rapid intravascular drug absorption from a bleeding surface. This view, however, has been challenged, and it has been suggested that steroid injection following aspiration of a haemarthrosis may prevent a subsequent chemical synovitis and accelerate recovery.[26] Recommended practice may change if and when more evidence becomes available. Further management depends on the cause of the haemarthrosis; rarely, this may be due to a bleeding disorder, anticoagulant treatment or a vascular lesion in the joint, e.g. a haemangioma.

- **Serous fluid streaked with fresh blood:** this is not uncommon and is usually related to the trauma of the aspiration. It may occur at the end of the procedure when the tap becomes dry, or during the procedure if the needle tip is moved (Figure 1.2B).
- **Blood mixed with serous fluid:** the terms haemoserous (predominantly blood) and serosanguinous (predominantly serous fluid) describe different types of mixed effusions.
- **Xanthochromic fluid:** this is old blood that has broken down and appears orange in colour. Its presence implies old trauma.
- **Turbid fluid:** inflammatory fluid tends to be less viscous than normal joint fluid, so it forms drops in the 'drip test'. It also looks darker and more turbid due to the increase in debris, cells and fibrin, and clots may form. It is impossible to say from the gross appearance what the inflammatory process is, so ***do not*** inject, but await results of direct microscopy and culture studies (Figure 1.3B).
- **Increasing joint inflammation** is associated with an increased volume of synovial fluid, reduced viscosity, increasing turbidity and cell count, and an increasing ratio of polymorphonuclear to mononuclear cells, but such changes are non-specific and must be interpreted in the clinical setting.[1]
- **Frank pus:** rare in practice; the patient is likely to be very ill and in need of urgent hospital admission. The aspirate may have a foul smell (Figure 1.3C).
- **Other aspirates:** uniformly milky-white fluid may result from plentiful cholesterol or urate crystals. Rice bodies are small shiny white objects composed of sloughed micro-infarcted synovial villi.

UNEXPECTED ASPIRATION

Sometimes, when performing an injection into a joint presumed to be dry, drawing back on the syringe to confirm that the needle is not in a blood vessel may unexpectedly aspirate joint fluid which then contaminates the injection solution. Using gloves and towels carefully disconnect the loaded syringe from the needle, taking care not to displace the needle tip or desterilize the tip of the syringe. Attach a fresh empty 10–20 ml syringe, lock it tightly onto the needle without displacement, and aspirate.

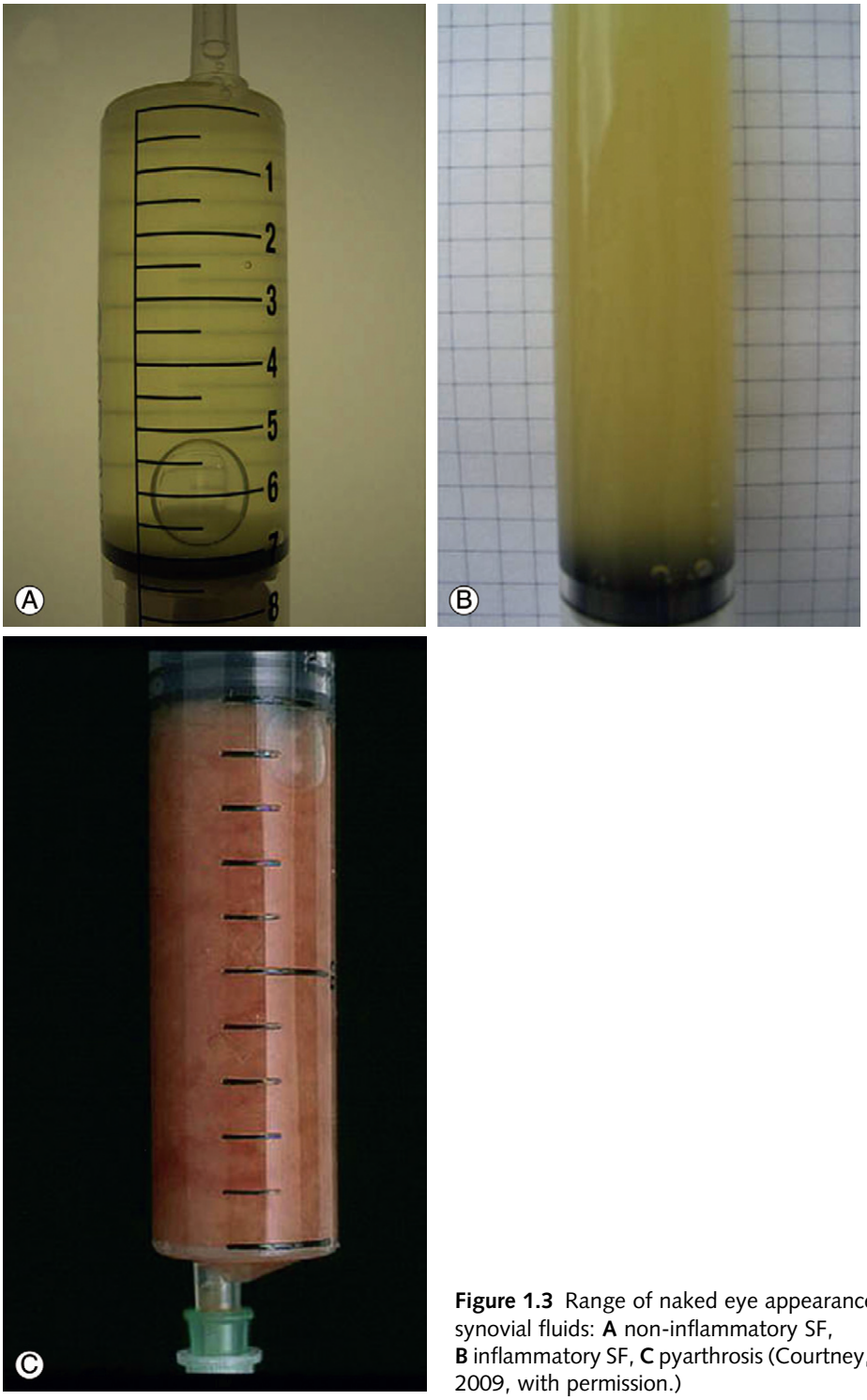

Figure 1.3 Range of naked eye appearances of synovial fluids: **A** non-inflammatory SF, **B** inflammatory SF, **C** pyarthrosis (Courtney, Doherty, 2009, with permission.)

If the aspirate is 'suspect' do not inject. If it remains appropriate to inject, you may use the original solution, providing it is not too heavily contaminated and that the end of the syringe is kept sterile e.g. by attaching it to a sterile needle. If in doubt, draw up a fresh solution and be sure to lock the syringe tightly onto the needle.

Very rarely, you may puncture a blood vessel, e.g. radial artery at the wrist in carpometacarpal (CMC) injection. Fresh bright-red arterial blood will pump into the syringe, which should be withdrawn and firm pressure applied over the puncture site for several minutes.

ASPIRATING GANGLIA

Ganglion cysts account for approximately 60 % of soft tissue, tumour-like swellings affecting the hand and wrist. They usually develop spontaneously in adults 20–50 years of age with a female-to-male preponderance of 3:1. The dorsal wrist ganglion arises from the scapholunate joint and constitutes about 65 % of ganglia of the wrist and hand. The volar wrist ganglion arises from the distal aspect of the radius and accounts for approximately 20–25 % of ganglia. Flexor tendon sheath ganglia make up the remaining 10–15%. These cystic structures are found near or are attached to tendon sheaths and joint capsules. The cyst is filled with soft, gelatinous, sticky and mucoid fluid.[27]

Most ganglia resolve spontaneously and do not require treatment. If the patient has symptoms, including pain or paraesthesia, or is disturbed by the appearance, aspiration without injection of a corticosteroid may be effective.[27] In a study comparing aspiration of wrist ganglia with aspiration plus steroid injection, both treatments had a 33% success rate. Almost all ganglia that recurred after one aspiration did not resolve with further aspirations. After aspiration and explanation of the benign nature of ganglia, only 25% of patients requested surgery.[28]

MISCELLANEOUS INJECTIONS

- **Gout:** joint aspiration in acute gout can ease pain and facilitate diagnosis. Aspiration of joints in the intercritical period (the interval between acute attacks) can also help make the diagnosis of gout. Intra-articular injection of steroid is an effective treatment; a single dose of triamcinolone acetonide 40 mg may resolve symptoms within 48 hours. Smaller doses, e.g. 10 mg in knee joints or 8 mg in smaller joints may also be effective. Intra-articular injection requires precise diagnosis and should not be used if there is a suspicion of joint infection. The two conditions may co-exist.[29,30]
- **Mucoid cysts:** mucoid cysts are small swellings typically found on the distal interphalangeal joints of patients with osteoarthritis. They are a form of ganglion and they communicate directly with the joint. On the affected finger they are often associated with nail ridging or deformity and frequently resolve after injection. In one study 60% had not recurred 2 years after receiving multiple punctures with a 25-gauge needle and a small volume (less than 1 ml) injection of steroid and LA.[31]

- **Rheumatoid nodules:** in one small study superficial rheumatoid nodules injected with steroid and local anaesthetic significantly reduced in volume or disappeared, compared with nodules injected with placebo, and with no significant complications.[32]

- **Trigger points:** trigger points are discrete, focal, hyper-irritable areas located in a taut skeletal muscle band. They produce local and referred pain and often accompany chronic musculoskeletal disorders. Trigger points may manifest as regional persistent pain, tension headache, tinnitus, temporomandibular joint pain, decreased range of motion in the legs and low back pain. A hypersensitive nodule of muscle harder than normal consistency is typical, and may cause radiation of pain and a local twitch response. The commonly encountered locations of trigger points and their pain reference zones are consistent.[33]

  Injection of 1% lidocaine without steroid can be effective. The trigger point is pinched between thumb and index finger and the needle is inserted 1–2 cm away and advanced into the trigger point at an angle of 30° to the skin. Warn the patient of the possibility of sharp pain or muscle twitching as the needle enters the area. 0.2 ml of LA is peppered until the local twitch response is no longer elicited or muscle tautness no longer perceived. Repeated injections are not recommended if two or three previous attempts have failed. Patients remain active, stretching muscles in the week afterwards.[34]

- **Dupuytren's contracture:** intralesional injection with corticosteroid may modify progression. Over a 4-year period 63 Dupuytren's patients (75 hands) were treated with a series of injections with triamcinolone directly into the nodules. The purpose of the study was to determine whether this could produce softening or flattening in this disease and in hypertrophic scars and keloids. After an average of 3.2 injections per nodule 97% of the hands showed regression; although some patients had complete resolution, most experienced definite but incomplete resolution (60% to 80%). A few patients did not experience recurrence in the injected nodules or development of new nodules, though 50% had reactivation 1–3 years after the last injection, necessitating 1 or more injections.[35]

- **Joint lavage:** joint lavage is a technique to wash out any loose tissue or debris from the joint space. It involves temporally inserting small tubes into one or more entry points in the knee and running normal saline into the joint. The fluid may run out of a tube on the other side of the knee or a bag of saline may be run into the knee and then drained back into the bag under gravity. A Cochrane review states that joint lavage does not result in a relevant benefit for patients with knee osteoarthritis in terms of pain relief or improvement of function.[36]

PHOTOGRAPHS

Photographs reproduced with permission from Courtney P, Dohetry M. Joint aspiration and injection and synovial fluid analysis. *Best Pract Res Clin Rheumatol* 2009;23(2):161–192.

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SAFETY, DRUGS AND SPORT, MEDICOLEGAL ISSUES

SECTION 1

Adverse reactions to corticosteroid are extremely rare: the drug more likely to provoke serious reaction is local anaesthetic. Simple precautions should always be undertaken, such as checking whether the patient has suffered any previous adverse reactions to the drug and ensuring that a strict aseptic no-touch technique is employed every time an infiltration is carried out (Section 2).

IMMEDIATE ADVERSE REACTIONS

The most important immediate adverse reactions to injection therapy are:

- Acute anaphylaxis
- Toxicity from local anaesthetic
- Syncope.

ACUTE ANAPHYLAXIS

Patients who have an anaphylactic reaction have life-threatening airway and/or breathing and/or circulation problems usually associated with skin and mucosal changes.[1]

Acute systemic anaphylaxis results from widespread mast cell degranulation triggered by a specific allergen. Clinically, it is characterized by laryngeal oedema, bronchospasm, and hypotension.[2] The true incidence of anaphylaxis is unknown; fatal anaphylaxis is rare but probably underestimated. A register established in 1992 recording fatal reactions gave an incidence of only 20 cases a year in the UK, of which half were iatrogenic, mainly occurring in hospital; a quarter were related to food allergy, and a quarter were related to venom allergy.[3]

True allergic reactions to local anaesthetic occur very rarely[4] and mainly with the ester-types e.g. procaine, and less frequently with the amide types e.g. lidocaine and bupivacaine.[5] The pathomechanism of immediate hypersensitivity reactions to local anaesthetic is largely unknown and is commonly regarded as 'pseudo-allergic' or 'non-immune type' anaphylaxis. Immunologically mediated reactions have rarely been observed with positive skin prick tests. Other ingredients in local anaesthetic preparations have to be considered as elicitors, e.g. preservatives like benzoates or sulfites or latex contaminants in injection bottles.[6]

A patient may be allergic to local anaesthetic and be unaware of it. Previous uneventful injection is not a guarantee they will not be allergic this time, though it does provide some reassurance.

RECOGNITION OF AN ANAPHYLACTIC REACTION

A diagnosis of anaphylactic reaction is likely if a patient who is exposed to a trigger (allergen) develops a sudden illness (usually within minutes of exposure) with rapidly progressing skin changes and life-threatening airway and/or breathing and/or circulation problems. The reaction is usually unexpected.

Anaphylactic reactions begin rapidly. The time taken for a full reaction to evolve varies. In a fatal reaction following an intravenous drug injection or insect sting the interval between exposure and collapse from cardiovascular shock is usually 5–15 minutes.[1] There are no data specifically relating to injection therapy.

The lack of any consistent clinical manifestation and a range of possible presentations cause diagnostic difficulty. Many patients with a genuine anaphylactic reaction are not given the correct treatment. Patients have been given injections of adrenaline inappropriately for allergic reactions just involving the skin, or for vasovagal reactions or panic attacks. Guidelines for the treatment of an anaphylactic reaction must therefore take into account some inevitable diagnostic errors, with an emphasis on the need for safety.

A single set of criteria will not identify all anaphylactic reactions. There is a range of signs and symptoms, none of which is entirely specific; however, certain combinations of signs make the diagnosis more likely. Skin or mucosal changes *alone* are not a sign of an anaphylactic reaction; skin *and* mucosal changes may be subtle or absent in up to 20% of reactions.

The features of an allergic reaction may be any of the following. Onset is usually abrupt; the patient feels and looks ill (Table 1.11).

Circulatory collapse, cardiac arrest and death may follow.

Table 1.11 Features of anaphylaxis

Symptoms	Signs
Nervousness	*Skin:* blotches, urticaria, decreased capillary filling, clammy, (cyanosis – late sign)
Feeling of impending catastrophe	*Eyes:* puffy, watering, red, sore
Feeling 'drunk' or confused	*Nose:* runny, sneezing
Metallic taste, difficulty swallowing	*Lips/tongue/throat* (angio-oedema) noisy breathing
Abdominal or back pain	*Voice:* stridor, difficulty talking, hoarse voice
Nausea, vomiting, diarrhoea	*Chest:* tachypnoea, wheezing, coughing
Itching	*Pulse:* tachycardia
Chest tightness	*Blood pressure:* profound hypotension
Difficulty breathing	*Neurological:* loss of consciousness, convulsions

TREATMENT OF SEVERE ALLERGIC REACTIONS

Patients having an anaphylactic reaction should be recognized and treated using the Airway, Breathing, Circulation, Disability, Exposure (ABCDE) approach and life-threatening problems treated as they are recognized.[1]

The exact treatment will depend on the patient's location, the equipment and drugs available, and the skills of those treating the reaction.[1] Clinicians will give

injection therapy in a variety of settings including hospitals with and without 'crash' teams, and various community premises including primary care and private facilities. Every clinician must prepare for the 'worst case scenario' in their setting and have a well thought out plan of action that is regularly reviewed in the light of current guidelines and individual experience. Basic life support skills should be acquired and maintained. Written protocols may be laminated and mounted in consulting rooms (Table 1.12).

Table 1.12 Immediate action in the presence of severe anaphylaxis

- Stop injecting
- Summon help
- Maintain airway
- Administer adrenaline intramuscularly
- Administer oxygen if necessary
- Give cardiopulmonary resuscitation if necessary
- Transfer the patient to hospital as quickly as possible if in the community

Adrenaline (epinephrine)

Adrenaline reverses the immediate symptoms of anaphylaxis by its effects on alpha and beta adrenoceptors. It reverses peripheral vasodilatation, reduces oedema, induces broncho-dilatation, has positive inotropic and chronotropic effects on the myocardium, and suppresses further mediator release. It may be harmful if given outside the context of life threatening anaphylaxis.[2]

In a series of deaths related to anaphylaxis two deaths occurred after adrenaline overdose in the absence of anaphylaxis, three deaths after adrenaline overdose in the management of allergic reactions, and two fatal myocardial infarctions occurred after adrenaline administration for mild iatrogenic reactions (where less aggressive treatment may have been appropriate).[7] Administering the doses recommended in the guidelines via the intramuscular route should avoid serious problems.

For further details on the current guideline for the management of anaphylaxis visit www.resus.org.uk/pages/reaction.pdf

TOXICITY FROM LOCAL ANAESTHETIC

Toxic effects from local anaesthetic are usually a result of excessive plasma concentrations. Care must be taken to avoid accidental intravascular injection. The main toxic effects are excitation of the central nervous system (CNS) followed by CNS depression (see Table 1.13).[5]

With intravenous injection convulsions and cardiovascular collapse may occur very rapidly. Significant toxic reaction to local anaesthetic are very unlikely with the dosages recommended here.

Table 1.13 Features of local anaesthetic toxicity

Symptoms	Signs
Lightheadedness Feeling drunk	Sedation Circumoral paraesthesia Twitching Convulsions in severe reactions

SYNCOPE

A few people may faint, not as a reaction to *what* was injected, but to *being* injected – the result of pain or needle phobia (Table 1.14). Patients who express apprehension before having an injection should lie down for the procedure; the clinician may be so intent upon placing the needle correctly that the warning features are missed. Unlike an anaphylactic reaction, which appears abruptly *following* the procedure, there are usually warning features *before* or *during* the procedure. There may be a history of fainting with previous invasive procedures, so do ask.

Syncope must be distinguished from an adverse drug reaction, and is treated by:

- ***reassuring*** the patient that they will shortly recover
- ***lying them down*** in the recovery position
- ***protecting the airway*** and giving 35% oxygen if loss of consciousness occurs.

Syncope may be accompanied by brief jerking or stiffening of the limbs, and may be mistaken for a convulsion by the inexperienced. Distinguishing a simple faint from a fit is helped by the presence of precipitating factors (painful stimuli, fear), and other features described above. Incontinence is rare, and recovery of consciousness usually occurs within a minute.[8]

Table 1.14 Features of syncope

Symptoms	Signs
Anxiety prior to the procedure	Apprehension
Lightheadedness, dizziness	Pallor
Tell you they are going to faint	Sweating
Nausea	Slight swaying
Ringing in the ears	Pulse: bradycardia
Vision 'going grey'	Blood pressure: hypotension

PREVENTION OF ADVERSE REACTIONS

The clinician must be prepared for any adverse reaction. Take the following precautions:

- Ask the patient about any known allergies to drugs, especially local anaesthetic
- If in doubt use steroid alone or diluted with normal saline
- Lie the patient on a treatment table for the procedure
- Control the amount of local anaesthetic given (see guidelines)
- Always aspirate before injecting, to check that the needle is not in a blood vessel
- Ask the patient to wait for 30 minutes after the injection
- Anyone with a suspected anaphylactic reaction should be referred to an allergy specialist.

ADVERSE REACTION REPORTING

In the UK any severe adverse reaction to any drug treatment should be reported to the Committee on Safety of Medicines (CSM) using the Yellow Card system. Yellow Card report forms can be found in the back of the British National Formulary (BNF).

HEALTH AND SAFETY

The clinician should be vaccinated against hepatitis B and have had a blood test to confirm immunity.[9] A booster vaccination every 5 years may be necessary. If in doubt, a doctor or hospital occupational health department specialist should be consulted.

Local policies on needle-stick injuries must be observed: in the UK there are national guidelines on the occupational exposure to HIV.[10,11] The best way to avoid a needle-stick injury is to be well organized and never to rush an injection.

EMERGENCY SUPPLIES FOR THE TREATMENT ROOM

Have a supply of emergency equipment and medication available.

Essential emergency kit

- Disposable plastic airways
- Ambubag and mask
- Adrenaline 1:1000 (1 mg/1 ml) strength or Epipen/Anapen devices
- Oxygen with masks and tubing

Additional emergency kit for medical personnel

- Chlorphenamine (Piriton) for injection
- Hydrocortisone for injection
- Nebulized salbutamol
- A selection of intravenous cannulae and fluid-giving sets
- Normal saline for infusion
- Plasma substitute for infusion

All drugs and fluids should be checked regularly to ensure they are in date.

DRUGS AND SPORT

Clinicians are advised to consult the latest World Anti-Doping Agency (WADA) World Anti-Doping Code and annually updated Prohibited List (International Standard) before prescribing or administering any therapeutic substance to a competitive athlete (www.wada-ama.org).

CORTICOSTEROIDS

In competition, corticosteroids come under Section 9 of the WADA 2010 Prohibited List. All glucocorticosteroids are prohibited when administered by oral, intravenous, intramuscular or rectal routes. In accordance with the International Standard for *Therapeutic Use Exemptions*, a *Declaration* of *Use* must be completed by the *athlete* for glucocorticosteroids administered by intraarticular, periarticular, peritendinous, epidural, intradermal and inhalation routes.

LOCAL ANAESTHETICS

The local anaesthetics mentioned on page 16 are not on the WADA prohibited list.

PLATELET RICH PLASMA

Platelet derived ('blood spinning') products administered by the intramuscular route are prohibited. Other routes of administration require a *Declaration of Use* in accordance with the International Standard for *Therapeutic Use Exemptions*.

THE WORLD ANTI-DOPING AGENCY RULES

Athletes are warned that they are subject to the rule of strict liability, which means that they are responsible for any prohibited substance found in their body. It is each athlete's personal duty to ensure that no prohibited substance enters his or her body. Athletes are responsible for any prohibited substance or its metabolites or markers found to be present in their samples. Accordingly, it is not necessary that intent, fault, negligence or knowing use on the athlete's part be demonstrated in order to establish an anti-doping violation under Article 2.1 of the WADA World Anti-Doping Code (last updated November 2009). www.wada-ama.org/en/World-Anti-Doping-Program/Sports-and-Anti-Doping-Organizations/The-Code

It is expected that most athletes competing in the Olympic Games who require a Therapeutic Use Exemption (TUE) would have already received it from their International Federation. Under the WADA code corticosteroids are one of a number of specified substances that are particularly susceptible to unintentional anti-doping rule violations because of their general availability in medicinal products. Doctors and athletes should seek specific advice about drug restrictions with their own sport's governing body.

Those who are not the team doctor and wish to use injection therapy for an athlete should discuss this with the team doctor. The athlete should be provided with a letter describing the rationale for treatment and the names and doses of drugs prescribed. If selected for a drugs test, the athlete should declare the treatment on the doping control form. Virtually insoluble corticosteroids may be detectable months after the injection, although just how many months ***is difficult to say.***

THERAPEUTIC USE EXEMPTION (TUE)

Athletes, like all others, may have illnesses or conditions that require them to take particular medications. If the medication an athlete is required to take to treat an illness or condition happens to fall under the Prohibited List, a Therapeutic Use Exemption (TUE) may give that athlete the authorization to take the needed medicine.

Criteria for granting a TUE:

- The athlete would experience significant health problems without taking the prohibited substance or method

- The therapeutic use of the substance would not produce significant enhancement of performance
- There is no reasonable therapeutic alternative to the use of the otherwise prohibited substance or method.

Under the World Anti-Doping Code, WADA has issued an International Standard for TUEs. This states that all International Federations (IFs) and National Anti-Doping Organizations (NADOs) must have a process in place whereby athletes with documented medical conditions can request a TUE, and have such request appropriately dealt with by a panel of independent physicians called a Therapeutic Use Exemption Committee (TUEC). IFs and NADOs, through their TUECs, are then responsible for granting or declining such applications.

DECLARATION OF USE

A declaration of use must be made for:

- glucocorticosteroids administered by localized injection (but *intramuscular* injection requires a TUE)
- platelet-derived preparations (e.g. platelet rich plasma) by non-intramuscular routes.

The UK Anti-Doping website www.ukad.org.uk has useful resources and links to:

- Declaration of Use Form
- Therapeutic Use Exemption Form
- Global Drug Reference On Line www.globaldro.com

The status of medications and substances may also be checked in the UK by using the Drug Enquiry Line on 0800 528 0004 or by emailing drug-free@uksport.gov.uk

THE USE OF LOCAL ANAESTHETICS IN COMPETITION

The use of local anaesthetic injections to temporarily block pain and allow athletes to compete while carrying a painful injury is a contentious issue.

In professional football the use of local anaesthetic painkilling injections can counter the performance-reducing impact of injury and lower the rate of players missing matches through injury. In the majority of cases, these injections are probably safe, although scientific evidence in this area is scant, particularly regarding long-term follow-up. The known long-term injury sequelae of professional football, such as increased rates of osteoarthritis of the knee (in particular), hip, ankle and lumbar spine, do not generally relate to the injuries for which local anaesthetic is commonly used. The most commonly injected injuries (acromioclavicular joint sprains, finger and rib injuries and iliac crest haematomas) are probably the safest to inject.[12]

Local anaesthetic injections as painkillers:[12]

- Should only be used when both the doctor and player consider that the benefits clearly outweigh the anticipated possible risks
- Intra-articular injections to the knee, ankle, wrist, joints of the foot, and to the pubic symphysis and major tendons of the lower limb are best avoided in most circumstances.

To enable the benefit and risk profile of local anaesthetic injections to be better understood, it is recommended that professional football competitions make local anaesthetics legal only with compulsory notification.[12]

Clinicians looking after athletes who request such interventions are recommended to read John Orchard's balanced description of his experience in Australian professional football. He concludes that local anaesthetic for pain relief can be used for certain injuries, though complications can be expected. Its use in professional football may reduce the rate of players missing matches through injury, but there are risks of worsening injuries and known specific complications, and players requesting injections should be made fully aware of these.[13,14]

ILLICIT USE OF PERFORMANCE ENHANCING DRUGS

Beware the athlete who is taking performance-enhancing drugs. They will probably not admit this, but if they develop complications from the use of anabolic steroids, for example, they might blame your injection. Look out for the very muscular athlete with bad skin. Otherwise healthy people, especially those who seem excessively dedicated to developing their physique, need to be asked specifically about their use of illicit drugs.[15]

MEDICOLEGAL CONSIDERATIONS

CONSENT

The courts require information to be disclosed to the patient in a discussion with the clinician. Thus simply handing patients an explicit consent form may not be considered enough unless the issues are discussed with patients and they have an opportunity to ask further questions.[16]

USE OF DRUGS BEYOND LICENCE

The following is adapted from 'The Use of Drugs Beyond Licence in Palliative Care and Pain Management; Recommendations of the Association for Palliative Medicine and The Pain Society' (2002). This statement should be seen as reflecting the views of a responsible body of opinion within these clinical specialties. The full document can be found at www.rcoa.ac.uk:

- The UK Medicines Control Agency grants a product licence for a medical drug. The purpose of the licence is to regulate the marketing activity of the pharmaceutical company; this does not limit prescription of the drug by qualified medical practitioners.
- *Licensed* drugs can be used legally in clinical situations that fall outside the remit of the licence (known as '*off-label*') e.g. different age group, indication, dose, route or method of administration. Sometimes off-label drugs are used because manufacturers have not sought to extend the terms of the licence for economic reasons, where costs are likely to exceed financial return.
- *Unlicensed* drugs refers to those products that have no licence for any clinical situation or may be in the process of evaluation.

- Injection therapy may involve the use of unlicensed drugs e.g. sclerosants, or 'off label' usage of licensed drugs e.g. Kenalog is not licensed to be mixed with lidocaine, and lidocaine is not licenced for intra-articular injection (although it is for surface infiltration and the caudal route).
- The risks presented to clinicians in using drugs beyond licence are best managed through clinical governance. Organizations should encourage staff to educate themselves and take responsibility for their own decisions within the framework of a corporate policy.
- The use of drugs beyond licence should be seen as a legitimate aspect of clinical practice and in pain management practice is currently both necessary and common.
- Choice of treatment requires partnership between patients and healthcare professionals, and informed consent should be obtained, whenever possible, before prescribing any drug.
- Patients should be informed of any identifiable risks and details of any information given should be recorded. It is often unnecessary to take additional steps when recommending drugs beyond licence.
- Health professionals involved in prescribing, dispensing and administering drugs beyond licence should select those drugs that offer the best balance of benefit against harm for any given patient. They should inform, change and monitor their practice in the light of evidence from audit and published research.
- Organizations providing pain management services should support therapeutic practices that are underpinned by evidence and advocated by a responsible body of professional opinion.

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SECTION 2

PRACTICAL GUIDELINES FOR INJECTION THERAPY

OVERVIEW

***Giving* injections is easy; it is *selection* of the suitable patient that is difficult**; it is possible to learn how to administer injections in a weekend; diagnosis, however, takes a lifetime.

In this section we emphasize the necessity of being able to fully understand the information the patient is imparting in the history, to clearly interpret the signs and symptoms elicited in the examination and finally, to eliminate the various differential diagnoses to arrive at a definitive diagnosis. Only in this way can one successfully achieve the desired result of selecting the patient who might respond to injection therapy (Table 2.1). This, combined with an in depth knowledge of functional anatomy, should enable the clinician to help relieve the many patients with pain from musculoskeletal lesions.

Table 2.1 Indications for corticosteroid injections, with or without local anaesthetic

- Acute and chronic bursitis
- Acute capsulitis
- Chronic tendinopathy
- Inflammatory arthritis
- Acute and chronic back pain and sciatica
- Nerve root entrapment
- Chronic ligament sprains

HOW TO USE THIS BOOK

Please study the following guidelines carefully before using any of the techniques. For ease of practical application, we have simplified each technique and present only the essential facts. In the sections that follow, each double page covers one anatomical structure showing an injection technique for the most common lesion found there; the text is on the left hand page and on the right hand page is a drawing of the anatomical site and a photograph of the injection position. Each anatomical area begins with joint injections, followed by soft tissue injections.

EXAMINATION

A brief outline of the minimal examination procedure is listed at the beginning of each section, together with the capsular patterns of the joints as described by Dr James Cyriax. The ***capsular pattern*** is a set pattern of limitation of range for each individual joint, which occurs whenever this joint suffers from capsulitis. The cause of the capsulitis could be osteoarthritis, systemic arthritis or trauma, but the ratio of limitation remains the same.

Taking a careful history and performing a thorough physical examination, followed by consideration of the potential differential diagnoses is an essential part of the treatment process. Give plenty of time to this part in order to be sure that the patient is suitable for injection.

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CAUSES AND FINDINGS

To aid patient selection the following points are presented:

- **main causes** of the lesion
- **usual site** of symptoms – pain or paraesthesia
- **positive clinical findings** – results of active, passive or resisted tests.

EQUIPMENT

In box form are the recommended sizes of syringe and needle, dosage and volume of corticosteroid and local anaesthetic, and total volume for the *average* sized patient.

Syringes

All needles and syringes must be of single-use disposable type and must be checked to ensure they are in date. Have available 1 ml, 2 ml, 5 ml, 10 ml and 20 ml sterile syringes; occasionally a 50 ml syringe might be necessary for aspiration (Table 2.2).

Use a small-bore, 1 ml tuberculin syringe for small tendons and ligaments because the resistance of the structure can require a certain amount of pressure. Considerable back pressure can cause a syringe to blow off the needle, and thus the clinician and patient to be sprayed with the solution – an embarrassing situation. Always ensure the needle is tightly attached to the syringe.

Needles

Use a large bore, such as 21G, sterile in-date needle for drawing up the drug/s. The size of the infiltrating needle depends on the size of the individual patient – select the finest needle of the appropriate length to reach the lesion. Even on a slim person, it is often necessary to use a 3.5 inch (90 mm) or longer needle to successfully infiltrate deep structures such as the hip joint or psoas bursa. It is better to use a longer needle than might appear necessary than one that is too short, which could necessitate withdrawing and starting again. When injecting with a long, fine, spinal needle it may be useful to keep the trochar in place to help control the needle as it passes through tissue planes, and then attach the syringe when the needle is in place.

Table 2.2 Common UK needle sizes and colours (other countries may use different colours)

Orange	25G	0.5 mm	0.5 to 5/8″ (16–20 mm)
Blue	23G	0.6 mm	1 to 1.25″ (25–30 mm)
Green	21G	0.8 mm	1.5 to 2″ (40–50 mm)
White	19G	1.1 mm	1.5″ (40 mm)
Black	Spinal 21/22G	0.7–0.8 mm	3–4″ (75–100 mm)

The drugs

Corticosteroid

We suggest the use of Kenalog® (triamcinolone acetonide 40 mg/ml) throughout. This is a remarkably safe drug but ***any appropriate corticosteroid*** can be used. In our experience, Kenalog gives less post-injection flare than Depo-Medrone, particularly in soft tissues, and is equally effective. Another advantage is that Kenalog can be used in both small and large areas. Adcortyl (triamcinolone acetonide 10 mg/ml) is useful where the total volume to be injected is over 5 ml; this allows greater volume for the same dose and avoids the need to dilute the local anaesthetic further with normal

saline – useful when injecting hip or knee joints. Depo-Medrone pre-mixed with lidocaine is commonly used but we find it more difficult to adjust for the individual lesion.

The effect of the corticosteroid does not usually kick in until about 48 hours after the injection, so the patient should be warned that they may not see any relief of pain until then. There is great variation in this time lag, some experiencing almost immediate improvement, others taking several days. The drug action continues for about 3 to 6 weeks.

In thin, dark skinned patients hydrocortisone may be used, especially when injecting superficial soft tissue lesions in order to avoid the potential risk of fat atrophy or depigmentation.

Local anaesthetic

We suggest the use of lidocaine hydrochloride throughout, but any suitable local anaesthetic can be used. Because of the risk of severe allergic reaction, the patient should be checked carefully for ***possible allergy*** to the drug before using any anaesthetic, for example previous dental work or skin stitches. Where any doubt exists ***do not use it***. Normal saline can be used to dilute the corticosteroid if necessary.

Lidocaine with epinephrine, which comes in ampoules or vials clearly marked in red, should not be used because of risk of ischaemic necrosis in appendages (page 16). Because of its potential half life of 8 hours or more, we do not recommend the routine use of Marcain but occasionally it can be used when a longer anaesthetic effect is needed. Some practitioners like to mix short- and long-acting anaesthetics to gain both the immediate diagnostic effect and the longer therapeutic effect.

Dosages

The corticosteroid doses suggested are what we use for the average-sized adult and are governed by the individual patient's ***age, size, general health*** and ***clinical history***. These are ***guidelines*** only and none are '***cast in stone***'; it is up to the clinician to decide on variants depending on individual preference and patient presentation. At all times, the ***minimum*** effective dose should be given; this will help prevent the appearance of adverse side effects such as facial flushing, intermenstrual bleeding, hyperglycaemia, skin atrophy and depigmentation.

It is important to keep within the recommended maximum doses of local anaesthetic in order to avoid toxicity. The safe maximum doses we suggest are given in Table 2.3. These doses are half the maximum published in pharmacological texts, so are well within safety limits (BNF).

In practice, this translates to the following:

- 2% lidocaine up to a maximum volume of 5 ml
- 1% lidocaine up to a maximum volume of 10 ml
- dilute 1% with normal saline (0.9%) for volumes larger than 5 ml.

Table 2.3 Local anaesthetics: suggested maximum doses

Drug	Strength	Maximum dose[1]	Suggested maximum
Lidocaine	0.5% 5 mg/ml 1.0% 10 mg/ml 2.0% 20 mg/ml	200 mg 40 ml 200 mg 20 ml 200 mg 10 ml	100 mg 20 ml 100 mg 10 ml 100 mg 5 ml
Bupivacaine	0.25% 2.5 mg/ml	150 mg 60 ml	

Volumes

Joints and bursae appear to respond best when sufficient volume of fluid to bathe the inflamed internal surfaces is introduced. Possibly the slight distension 'splints' the structure, or maybe it breaks down or stretches out adhesions. In a small patient the amounts are decreased and in a large patient they may be increased. Greater volume can be obtained by using normal saline, and especially in the case of the knee joint where the synovial folds encompass a large total area, greater volume is always recommended in order to bathe the entire inflamed surface.

The volumes suggested in Table 2.3 are well within safety limits and will not cause the joint capsule to rupture; for instance it is not unusual to aspirate over 100 ml of blood from an injured knee joint. In any case, the back pressure created by too large a volume would blow the syringe off the fine needle recommended, long before the capsule was compromised (Table 2.4).

Table 2.4 Joint injections: suggested average doses and total volumes

Joint	Dose	Volume
Shoulder	40 mg	5 ml
Elbow	30 mg	4 ml
Wrist	20 mg	2 ml
Thumb	10 mg	1 ml
Fingers	5 mg	0.5 ml
Hip	40 mg	5 ml
Knee	40 mg	5 to 10 ml
Ankle	30 mg	4 ml
Foot	20 mg	2 ml
Toes	10 mg	1 ml

Conversely tendons should have ***small*** volumes injected. This avoids painful distension of the structure and minimizes risk of rupture. An average 'recipe' for tendons is given in Table 2.5.

Table 2.5 Tendon injections: suggested average doses and volumes

- ***Small tendons***: 10 mg of steroid plus local in a total volume of 1 ml
- ***Large tendons***: 20 mg of steroid plus local in a total volume of 2 ml

ANATOMY

This section gives tips for easy ways to localize and imagine size of anatomical structures, based on functional and surface anatomy. Finger sizes refer to the patient's fingers, not the clinician's.

TECHNIQUE

We describe a logical sequence for administration of the solution, and ways of performing a safe and relatively painless injection (Table 2.6).

Wet hands carry more risk of infection so hands must be well dried before injecting – see the technique recommended by the World Health Organization.[2,4-7] Gloves are mandatory in some countries; we recommended wearing gloves when aspirating, but they do not need to be sterile.[8]

Table 2.6 Aseptic technique

The following simple precautions should be taken to prevent the occurrence of sepsis:

- Remove watches and jewelry
- Mark injection site with closed end of sterile needle guard, then discard
- Clean injection site with appropriate cleanser and allow 1 min to dry[2,3]
- Wash hands for 1 min; dry well with disposable paper towel
- Use pre-packed, in-date, sterile disposable needles and syringes
- Use single-dose ampoules or vials, then discard them
- Change needles after drawing up the solution
- Do not touch skin after marking and cleansing the injection site
- Do not guide needle with your finger
- When injecting joints, aspirate to check that any fluid does not look infected

Injections should not be painful. Skin is very sensitive, especially on the flexor surfaces of the body, and bone is equally so. Muscles, tendons and ligaments are less sensitive and cartilage virtually insensitive. Pain caused at the time of the injection is invariably the result of poor technique – '***hitting***' bone with the needle instead of '***caressing***' it. After-pain can be caused by a traumatic periostitis because of damaging bone with the needle, or possibly by flare caused by the type of steroid used. Success does not depend on a painful flare after the infiltration.

Maximizing patient comfort during an injection

Maintain a calm confident approach throughout the procedure and keep a conversation going. Avoid letting the needle-phobic patient see the needle as you draw up! Placing the heel of the operating hand on the patient near to the injection site controls any shaking and allows the process to be more controlled. Following these three simple rules helps to make the procedure relatively painless:

- ***strongly stretch*** skin between finger and thumb
- hold needle close to and ***perpendicular*** to skin
- insert needle ***rapidly*** just into epidermis.

The secret of giving a reasonably comfortable injection depends on using the needle as an extension of the finger and once through the skin, slowly and gently passing through the tissues, monitoring the texture of the structures. The usual 'feel' of different tissues is as follows:

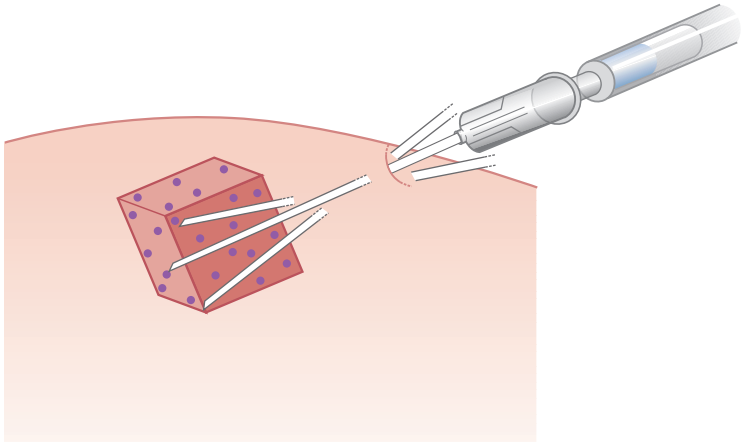
- muscle: spongy, soft
- tendon or ligament: fibrous, tough
- capsule: sometimes slight resistance to needle
- cartilage: sticky, toffee-like
- bone: hard and extremely sensitive.

Once the needle has reached the correct structure, always attempt to aspirate; this enables you to see if the needle tip is in a blood vessel, or if there is any fluid which should be removed.

Bolus and peppering procedures

Bursae, joint capsules and ***synovial tendon sheaths*** are hollow structures that require the solution to be deposited in one amount – a ***bolus*** technique. No resistance to the introduction of fluid indicates that the needle tip is within a space. Chronic bursitis, especially at the shoulder, can result in loculation of the bursa. This gives the sensation of pockets of free flow and then resistance within the bursa, rather like injecting a sponge – so the needle must be moved around to infiltrate all the pockets.

Tendons and ***ligaments*** require a ***peppering technique***. This helps to disperse the solution throughout the structure and to eliminate the possibility of rupture. The needle is gently inserted to caress the bone at the enthesis and the solution is then introduced in little droplets, as if into all parts of a cube (see Figure 1). Knowing the three-dimensional size of the structure is essential as this indicates the volume of fluid required and how much the needle tip has to be moved around. There is only one skin puncture; this is not multiple acupuncture.



Tendons with sheaths: after inserting the needle perpendicular to the skin, angle the needle alongside the tendon within the sheath and introduce the fluid. The fluid should flow easily; resistance indicates that the needle tip is within the tendon itself. Often a small bulge is observed contained within the sheath.

Blood vessels: avoid puncturing a large blood vessel – if this occurs, apply firm pressure over the site for 5 minutes (vein) or 10 minutes (artery).

Aspiration

Aspiration can be planned or unplanned. Planned aspirations are common for the knee joint, olecranon bursa, Baker's cyst and ganglia. If the area, for example the knee joint, looks swollen or feels warm, fluid will be present and aspiration is a strong possibility, so the equipment can be prepared (Table 2.7). Occasionally, when drawing back on the plunger, unexpected aspiration occurs. To be ready for this, it is useful to have a large syringe and needle to hand when injecting large joints.

Aspirate slowly and check any aspirated fluid – if sepsis or abnormal pathology is suspected, detach syringe from needle, aspirate with a fresh syringe, deposit 1–2 ml in sterile container and send for culture. Abandon the injection.

Table 2.7 Aspiration equipment

- 20 or 50 ml syringe
- 18G needle
- Paper towels to cover surface
- Gloves
- Kidney bowl
- Sterile named container for sample

If the fluid looks like normal serous fluid – clear, with the viscous consistency of runny honey – continue to aspirate while pressing with the flat hand on the area. The remaining fluid should be deposited into kidney bowl and disposed of according to local policy.

The question then is, should the aspirated joint be injected at the same time? We believe this depends on the experience of the aspirating clinician; if confident that the aspirate is normal serous fluid, and the patient's symptoms warrant it, injection of corticosteroid with or without local anaesthetic, can continue. If fresh blood is removed, fracture should be eliminated; if there is no fracture and the diagnosis is a ruptured anterior cruciate ligament for example, we would inject steroid for its anti-inflammatory pain-relieving action.

Comments This section describes the expected results of the treatment and any complications or difficulties that might occur.

ALTERNATIVE APPROACHES

There is usually more than one way to give an injection. We have selected approaches which we find to be the safest, easiest for the injector and least uncomfortable for the patient. Here we describe equally effective or alternative ways where appropriate.

AFTERCARE

Most injection studies show that injections give demonstrable relief in the short term but there is not much difference from other treatments or no treatment at all in the long term. It is essential, therefore, to address the ***causes*** of the pain once the symptoms of pain or parasthesia have been relieved by the injection. Recurrence of symptoms is common in bursitis and tendinopathy, so appropriate advice on prevention is a vital part of the care package.

The ideal outcome is total relief of pain with normal power and full range of motion. This does not always occur but when local anaesthetic is used there should be significant immediate improvement to encourage both patient and clinician that the correct diagnosis has been made, and the injection accurately placed.

The patient should be told that the relief of pain might be temporary, depending on the strength and type of anaesthetic used, and the pain may return when this effect wears off. Some patients describe this pain as greater than their original pain. This might be due to the flare effect of the cortisone, which is thought to be caused by microcrystal deposition, or because of poor injection technique where the needle has been rammed into bone, but it is also possible that pain that comes back after some relief might ***appear*** to be worse. Any after-pain is usually transient and can be eased by application of ice or taking simple analgesia.

The anti-inflammatory effect of the corticosteroid is not usually apparent until about 48 hours after the infiltration and can continue for 3 weeks to 2 months, depending on the drug used, so patients should maximize the drug action during this period by avoiding aggravating activities.

Arrange to review the patient about a week or 10 days later. If the pain is severe or begins to return, as occurs commonly in acute capsulitis of the

shoulder, see that the patient knows that they can return for a further injection if necessary within this period.

Advise the patient on what to do and what to avoid in the intervening period. Joint conditions usually benefit from a programme of early ***gentle movement*** within the pain-free range[9]; studies have shown that 24 hours' complete bed rest after a knee injection for inflammatory arthritis is beneficial but in the case of the wrist immobilization does not appear to improve outcome and might even worsen it. Overuse conditions in tendons and bursae require ***relative rest***; this means that normal activities of daily living can be followed, provided they are not too painful, but return to sport or strenuous repetitive activity should be postponed until the patient is as pain free as possible.

When the symptoms have been relieved, most patients will need a few sessions of treatment for rehabilitation and prevention of recurrence; this is particularly relevant in overuse conditions and might involve correction of posture, ergonomic advice, adaptation of movement patterns, mobilization or manipulation, deep friction massage, stretching and/or strengthening regimens. The advice of a professional coach in their sport or of an expert in orthotics might also be required.

CONTRAINDICATIONS TO INJECTION THERAPY

ABSOLUTE CONTRAINDICATIONS

On no account should an injection be performed in the following:

- **Hypersensitivity or allergy** to any of the drugs used: risk of anaphylaxis
- **Sepsis** – local or systemic: creates focus for microbes
- **Reluctant patient** or no informed consent given: medicolegal factors
- **Children under 18**: (except juvenile arthritis) children usually heal well
- **Recent fracture** site: delays bone formation
- **Prosthetic joint**: risk of infection
- **Gut feeling**: when in doubt, do not inject.

RELATIVE CONTRAINDICATIONS

Injections should be undertaken only if the extra risk is merited with:

- **Bleeding risks:**
  Anticoagulant therapy: but no good evidence of increased bleeding risk
  Haemarthrosis: but this is disputed. Pain relief from aspiration alone can be dramatic
- **Diabetes:** greater risk of sepsis, blood sugar levels may rise for a few days
- **Immunosuppressed:** by disease e.g. leukaemia, or drugs e.g. systemic steroids
- **Large tendinopathies:** e.g. Achilles, infrapatella tendon (image first)
- **Pregnancy:** medicolegal factors
- **Psychogenic pain:** pain may be perceived to be aggravated.

PREPARATION PROTOCOL

PREPARE PATIENT

- Take history and examine patient
- Check for absolute or relative contraindications
- Discuss all treatment options, injection procedure and possible side effects
- Obtain informed consent and record this
- Place in comfortable supported position with injection site accessible.

SELECT DRUGS

- Decide on total **volume** based on size of structure
- Choose **dose** of drug/s; use minimal effective amount
- Select corticosteroid and/or single-use local anaesthetic ampoules/vials
- Check names, strengths and expiry dates.

ASSEMBLE EQUIPMENT

- Appropriate size in-date sterile syringe
- Sterile in-date green 21G needle for drawing up
- Sterile in-date needle of correct length for infiltrating
- Alcohol swab or iodine skin preparation
- Cotton wool/gauze and skin plaster – check for allergy
- Waste bin and sharps box
- Spare syringe and sterile container if aspiration likely.

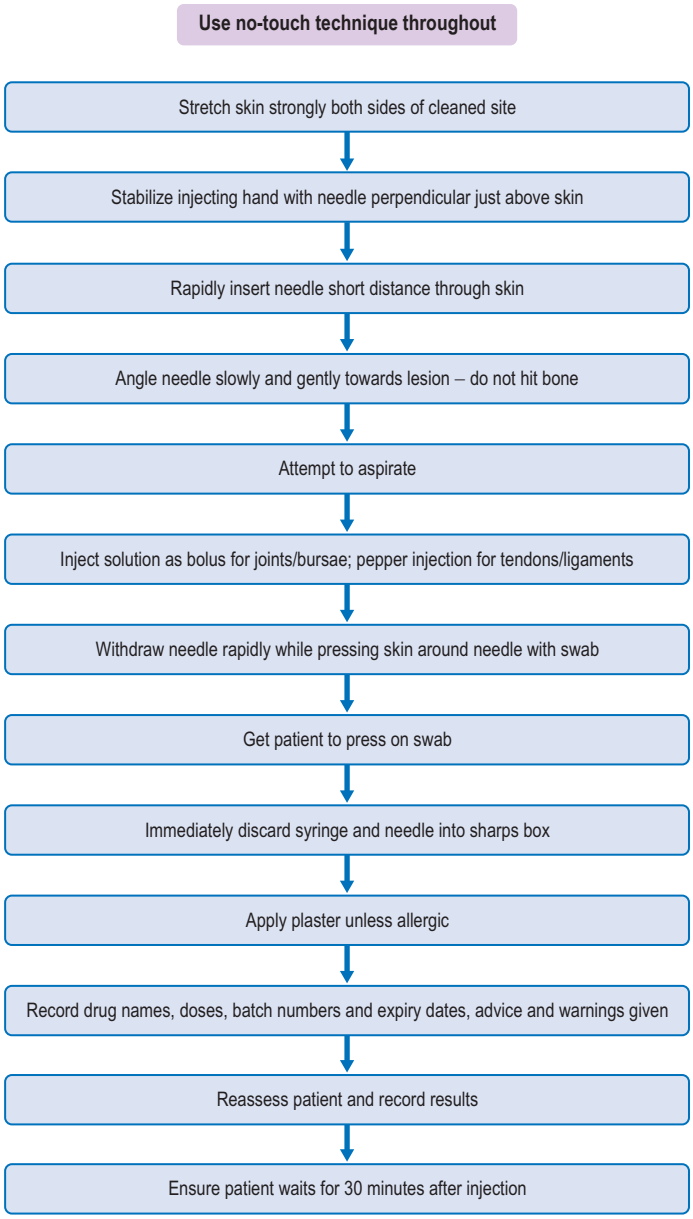
PREPARE SITE

- Identify structure and stretch skin strongly between finger and thumb
- Mark injection site with end of fresh needle cap, then discard
- Clean skin with suitable preparation in an outward spiral motion.

PREPARE INJECTION

- Wash hands with cleanser for 1 minute and dry well with paper towel
- Open vial/s and ampoule/s
- Attach green 21G needle to appropriate-sized syringe
- Draw up accurate dose of steroid
- Draw up accurate dose of local anaesthetic if used
- Discard needle in sharps box
- Attach needle of correct length firmly to syringe
- Take loaded syringe and fresh swab to patient.

INJECTION TECHNIQUE FLOWCHART



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SECTION 3

UPPER LIMB INJECTIONS

EXAMINATION OF THE UPPER LIMB

The capsular pattern is a set pattern of loss of motion for each joint. It indicates that there is some degree of joint capsulitis caused by degeneration, inflammation or trauma. There may be a hard end feel in advanced capsulitis

Shoulder tests

Active flexion above head
Passive flexion with overpressure
Active abduction to ear for painful arc
Passive lateral rotation
Passive abduction
Passive medial rotation
Impingement/lag/stability/proprioception tests

Resisted abduction
Resisted lateral rotation
Resisted medial rotation
Resisted elbow flexion
Resisted elbow extension
Resisted adduction

Shoulder capsular pattern: most loss of *lateral rotation*, less of *abduction,* least of *medial rotation*

Elbow tests

Passive flexion
Passive extension
Passive pronation
Passive supination

Resisted flexion
Resisted extension
Resisted pronation
Resisted supination
Resisted wrist flexion
Resisted wrist extension

Elbow capsular pattern: more loss of *flexion* than *extension*

Wrist tests

Passive pronation
Passive supination
Passive extension
Passive flexion
Passive radial deviation
Passive ulnar deviation

Resisted extension
Resisted flexion
Resisted radial deviation
Resisted ulnar deviation

Wrist capsular pattern: equal loss of *flexion* and *extension*

Finger tests

Passive thumb extension
Resisted thumb abduction
Resisted thumb adduction
Resisted thumb extension
Resisted thumb flexion

Passive finger extension
Passive finger flexion
Resisted finger abduction
Resisted finger adduction

Finger capsular patterns: *Loss of:*
Thumb: *extension* & *abduction*
Metacarpophalangeal joints: *extension* and *radial deviation*
Interphalangeal joints: *flexion*
Distal phalangeal joints: *extension*

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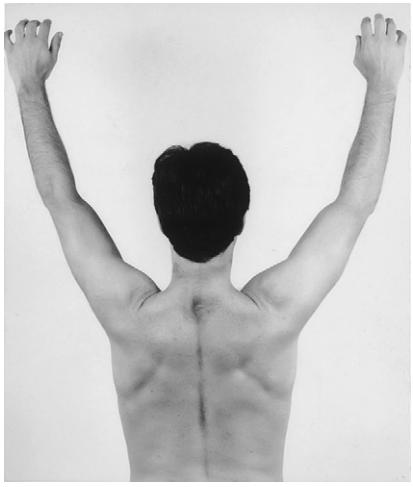
Shoulder Examination

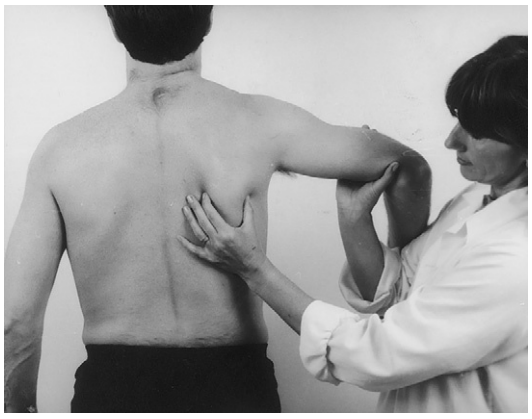


1. Active flexion above head

2. Passive flexion with overpressure

3. Active abduction to ear for painful arc

4. Passive lateral rotation



5. Passive abduction

6. Passive medial rotation

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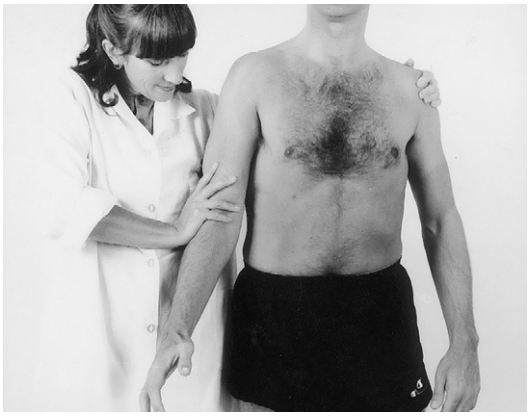
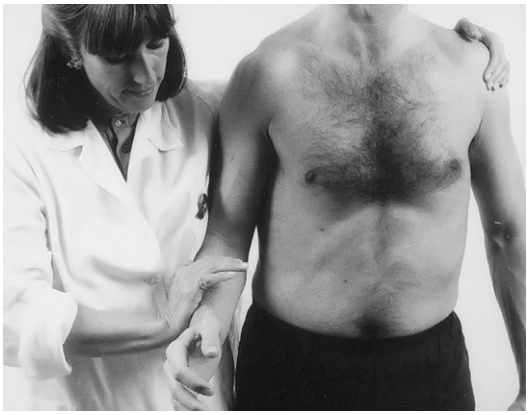


7. Resisted abduction



8. Resisted lateral rotation

9. Resisted medial rotation

10. Resisted elbow flexion

11. Resisted elbow extension

12. Resisted adduction

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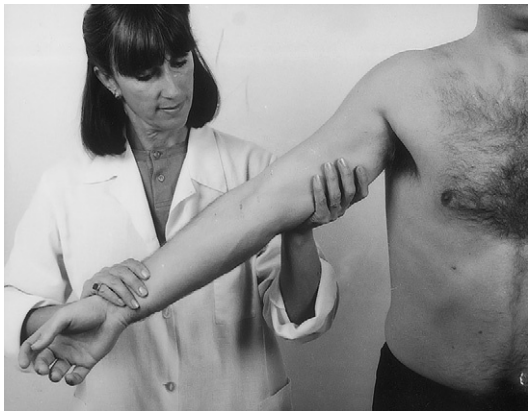
Elbow Examination

1. Passive flexion



2. Passive extension

3. Passive pronation

4. Passive supination

5. Resisted flexion

6. Resisted extension

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7. Resisted pronation

8. Resisted supination

9. Resisted wrist flexion

10. Resisted wrist extension

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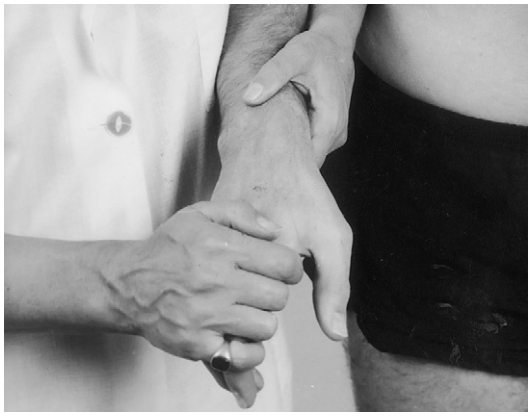
Wrist and Hand Examination

1. Passive pronation

2. Passive supination

3. Passive extension

4. Passive flexion



5. Passive ulnar deviation

6. Passive radial deviation

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7. Resisted extension

8. Resisted flexion

9. Resisted radial deviation

10. Resisted ulnar deviation

11. Passive thumb extension

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12. Resisted thumb abduction

13. Resisted thumb adduction

14. Resisted thumb extension

15. Resisted thumb flexion

16. Resisted finger abduction

17. Resisted finger adduction

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GLENOHUMERAL JOINT

Acute or chronic capsulitis – 'frozen shoulder'

Causes and findings

- Trauma, osteoarthritis or rheumatoid arthritis, idiopathic or secondary to neurological disease, diabetes, stroke, etc
- Pain in deltoid area, possibly radiating down to hand in severe cases, aggravated by arm movements and lying on shoulder
- Painful and limited: capsular pattern – most loss of lateral rotation with hard endfeel

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
5 ml	Green 21G 1.5–2" (40–50 mm)	40 mg	4 ml 1%	5 ml

Anatomy

The shoulder joint is surrounded by a large capsule and the easiest and least painful approach is posteriorly, where there are no major blood vessels or nerves. An imaginary oblique line running anteriorly from the posterior angle of the acromion to the coracoid process passes through the shoulder joint. The needle follows this line, passing through deltoid, infraspinatus and posterior capsule. The end point should be the sticky feel of cartilage on the head of the humerus or the glenoid.

Technique

- Patient sits with arms folded, thus opening up the posterior joint space
- Identify posterior angle of acromion with thumb, and coracoid process with index finger
- Insert needle directly below angle and pass anteriorly obliquely towards coracoid process until needle gently touches intra-articular cartilage
- Inject solution as a bolus

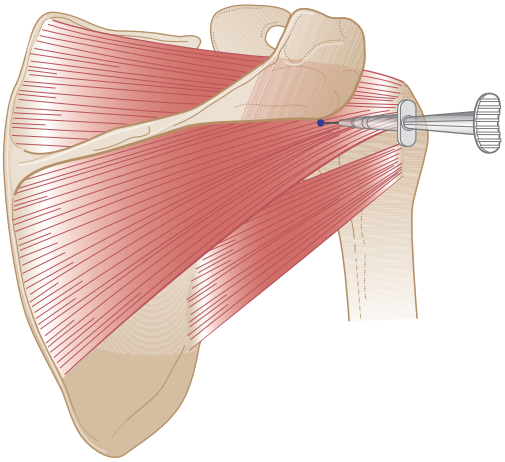
Comments

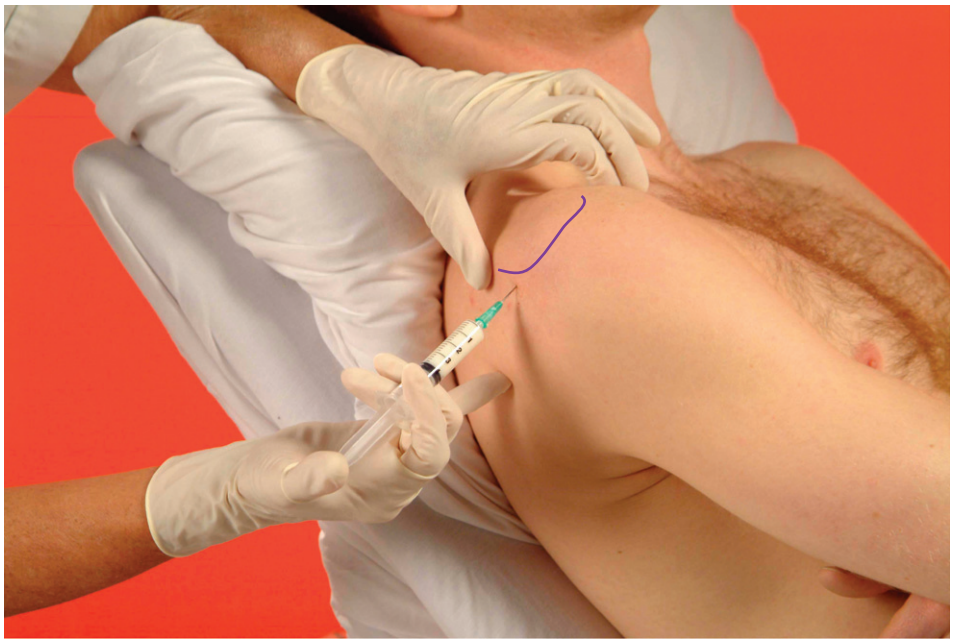
The less the radiation of pain and the earlier the joint is treated, the more dramatic is the relief of symptoms. If there is resistance to the injection, the needle has probably been inserted too laterally and must be repositioned more medially. Occasionally there is slight resistance when the needle passes through the capsule. Usually one injection suffices in the early stages of the condition, but if necessary more can safely be given at increasing intervals of a week, 10 days, 2 weeks, etc.; it is sometimes necessary in advanced capsulitis to give four to six injections over about 2 months. Advise the patient that a repeat dose might be needed if the symptoms are severe and gradually return as the effect of the drug wears off.

Alternative approaches

Rarely the posterior approach is not effective, so an anterior approach is used. In this case, the arm is held in slight lateral rotation and the needle inserted on the anterior surface between the coracoid process and the lesser tuberosity of the humerus, and aimed posteromedially towards the spine of the scapula. The same dose and volume is used. The disadvantages to this approach are that the patient can see the needle advancing, the flexor skin surfaces are more sensitive and there are more neurovascular structures lying on the anterior aspect of the shoulder.

Adcortyl (10 mg/ml) can be used for this injection, especially in large shoulders where more volume is required; the dose would then be 4 ml of Adcortyl with 4 ml of 1% local anaesthetic. Smaller patients may require only 30 mg of corticosteroid.





Aftercare Patient maintains mobility with pendular and stretching exercises within the pain-free range, progressing to stronger stretching when pain is reduced. Strong passive stretching of the capsule can be given when the pain has abated. A strengthening and stabilizing programme is often required, together with postural correction.

ACROMIOCLAVICULAR JOINT

Acute or chronic capsulitis

Causes and findings

- Trauma or occasionally prolonged overuse in a degenerative shoulder
- Pain at point of shoulder: a bump of bone or swelling may be seen
- Painful: all full passive movements, especially full passive horizontal adduction
  occasionally painful arc on active elevation

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The acromioclavicular joint line runs in the sagittal plane about a thumb's width medial to the lateral edge of the acromion. The joint plane runs obliquely medially from superior to inferior and usually contains a small meniscus. Often a small step can be palpated where the acromion abuts against the clavicle, or a small V-shaped gap felt at the anterior joint margin. Passively gliding the acromion downwards on the clavicle may help in finding the joint line.

Technique

- Patient sits supported with arm hanging by side to slightly separate the joint surfaces
- Identify lateral edge of acromion. Move medially about a thumb's width and mark mid-point of joint line
- Insert needle angling medially about 30° from the vertical and pass through capsule
- Inject solution as a bolus

Comments

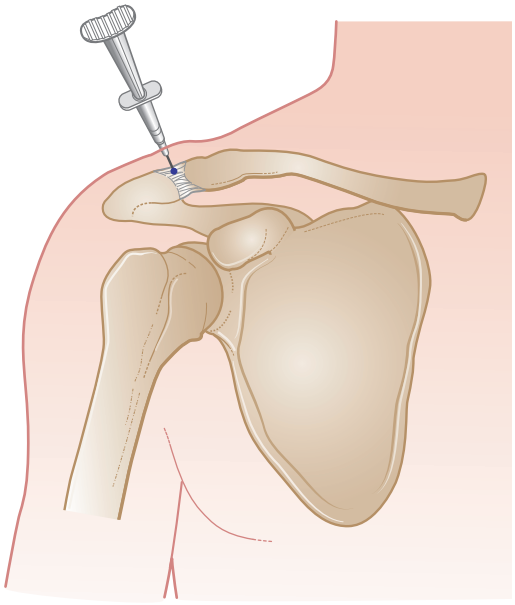
Occasionally the joint is difficult to enter; it is normally a narrow space and degenerative changes make it more so. Traction on the arm can open up the joint space and peppering of the capsule with the solution will anaesthetize it while feeling for the joint space with the needle. This will avoid giving unnecessary pain.

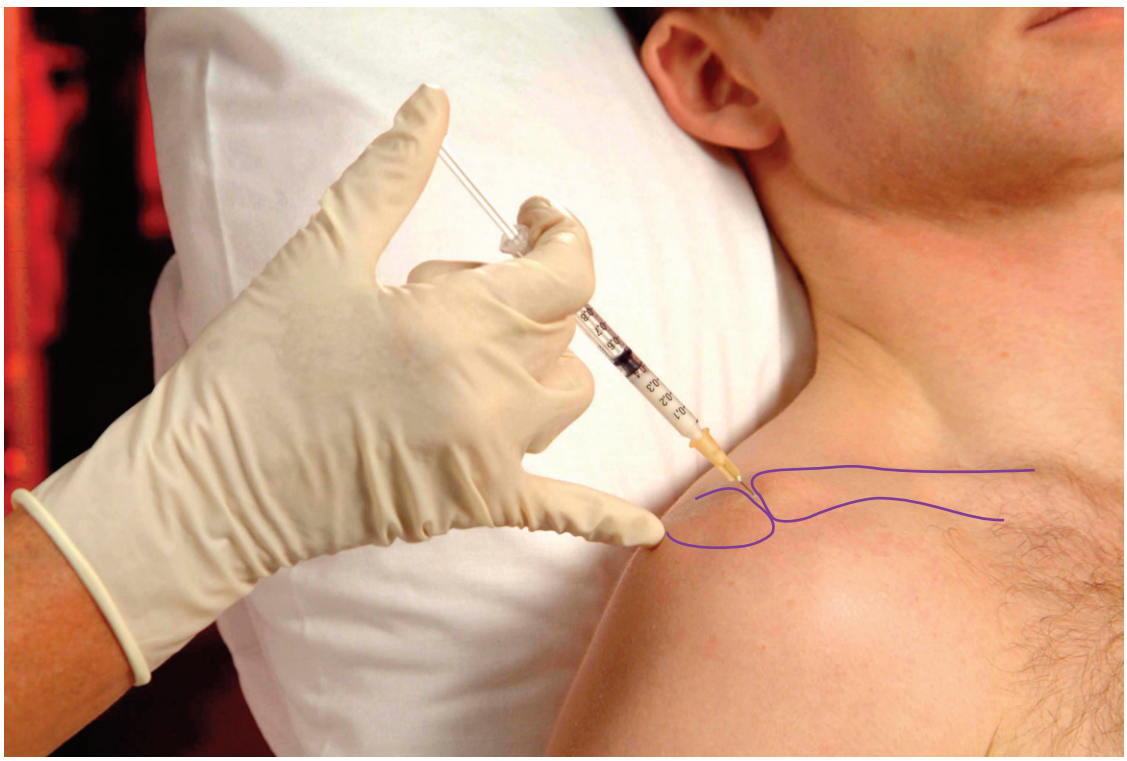
Alternative approach

The joint can also be injected anteriorly and horizontally at the V-shaped gap if the superior approach is difficult. The unstable or repeatedly subluxing joint can be helped by sclerosing injections or possibly surgery.

Aftercare

The patient should rest the shoulder for a week then begin gentle mobilizing exercises. Acutely inflamed joints are helped by the application of ice, taping across the joint to stabilize it and by oral pain killers.





STERNOCLAVICULAR JOINT

Acute or chronic capsulitis

Causes and findings

- Trauma, overuse in the degenerate shoulder or occasionally rheumatoid arthritis
- Pain over sternoclavicular joint
- Painful: retraction and protraction of the shoulder
  full elevation of the arm
  clicking or subluxation after trauma

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5" (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The sternoclavicular joint contains a small meniscus that can sometimes be damaged and then give painful symptoms. The joint line runs obliquely laterally from superior to inferior and can be identified by palpating the joint medial to the end of the clavicle while the patient protracts and retracts the shoulder.

Technique

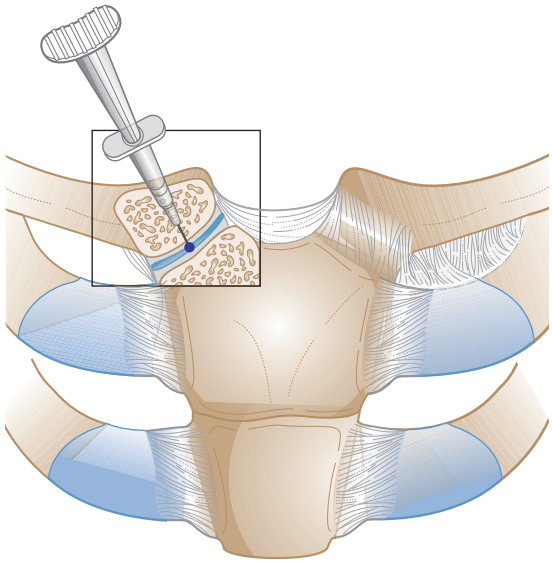
- Patient sits supported with arm in slight lateral rotation
- Identify mid-point of joint line
- Insert needle perpendicularly through joint capsule
- Inject solution as a bolus

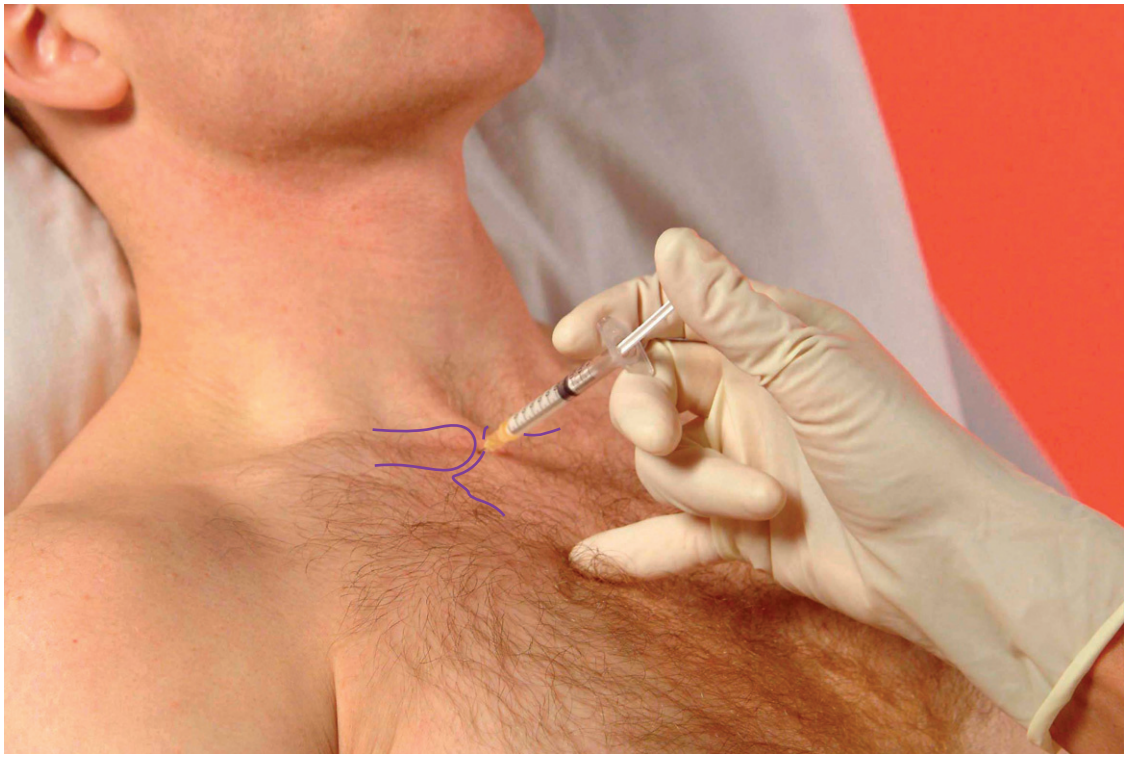
Comments

Although not a common lesion, this usually responds well to one infiltration.

Aftercare

Rest for a week followed by mobilization and a progressive postural and exercise regimen. Taping the joint helps stabilize it in the acute stage after trauma.





SUBACROMIAL BURSA

Chronic bursitis

Causes and findings

- Overuse or occasionally trauma
- Chronic pain in deltoid area, occasional referral down arm
- Painful: passive elevation and medial rotation more than lateral rotation. Resisted abduction and lateral rotation, often on release of resistance – these two tests often appear weak due to muscle inhibition. Possible arc, 'muddle' of signs, with resisted tests less painful when tested under distraction

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
5 ml	Blue 21G 1.25″–1.5″(30–40 mm)	20 mg	4.5 ml 1%	5 ml

Anatomy

The bursa lies mainly under the acromion but is very variable in size and can extend distally to the insertion of deltoid. Occasionally a tender area can be palpated around the edge of the acromion. Sometimes the bursa communicates with the glenohumeral joint capsule.

Technique

- Patient sits with arm hanging by side to distract humerus from acromion
- Identify lateral edge of acromion
- Insert needle at mid-point of acromion and angle slightly upwards under acromion to full length
- Slowly withdraw needle while simultaneously injecting as a bolus wherever there is no resistance

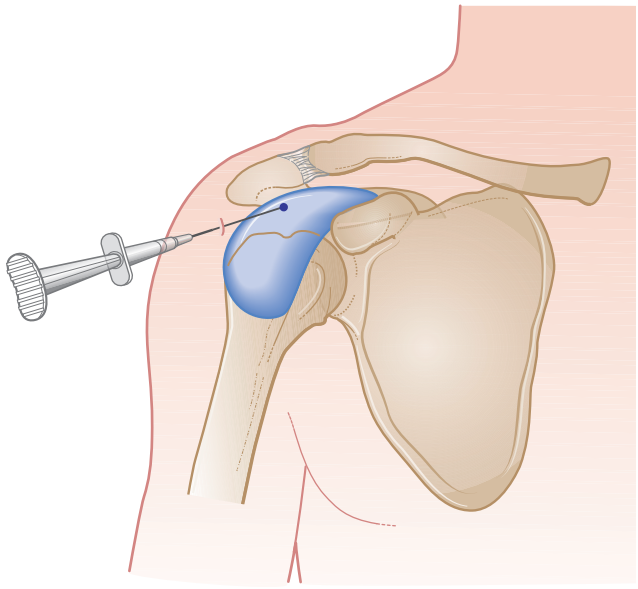
Comments

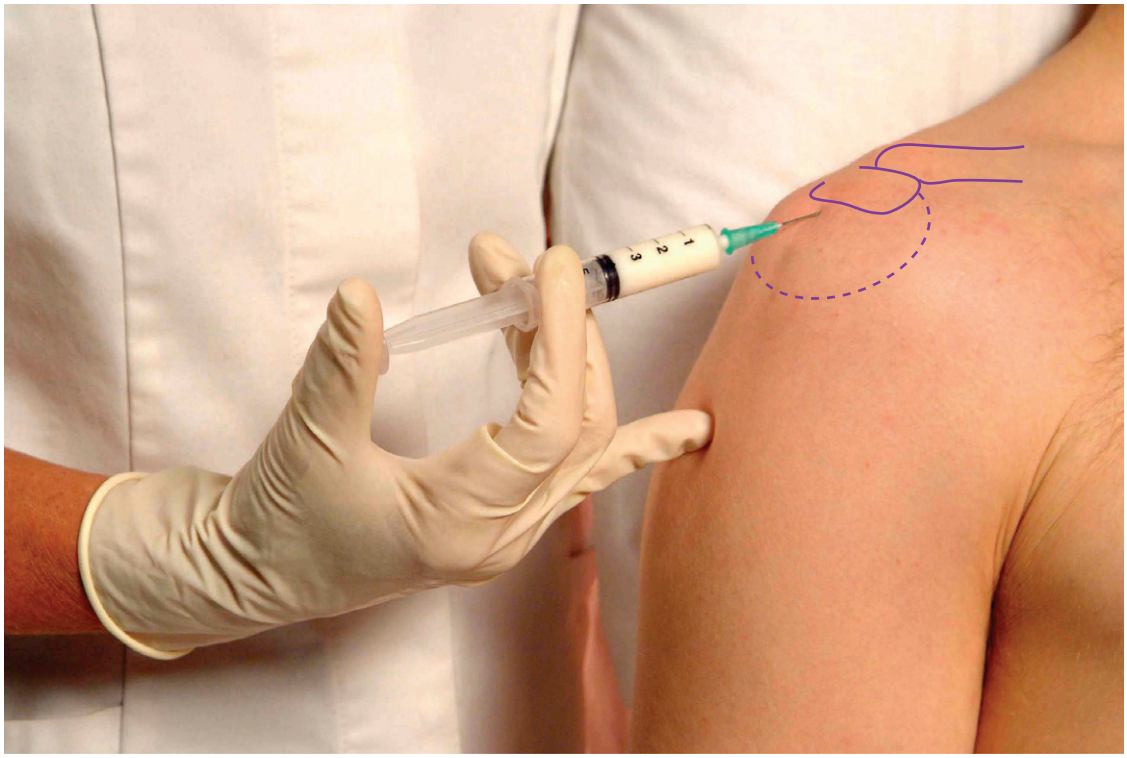
In our experience, this is the most common injectable lesion seen in orthopaedic medicine (Appendix 2). Results are usually excellent; relief of pain after one injection is usual but the rehabilitation programme must be maintained. If, rarely, the symptoms persist after two injections, the shoulder should be scanned because a cuff tear might be present. In thin patients, the fluid sometimes causes visible swelling around the edge of the acromion.

Alternative approaches

There is often loculation in long-standing bursitis. In this case, resistance is felt when injecting the solution, so the needle must be fanned around under the acromion to pepper separate pockets of the bursa – the sensation is that of injecting a sponge. Occasionally, calcification occurs within the bursa and hard resistance is felt. Infiltration with a large-bore needle and local anaesthetic may help. Failing this, surgical clearance is recommended. If palpable tenderness is found either anterior or posterior to the acromion, the injection can be given at these sites.

Acute subacromial bursitis is much less common and presents with spontaneous, rapidly increasing severe pain over a few days, which may radiate down as far as the wrist. The patient is often unable to move the arm at all and sleep is very disturbed. It should be injected in the same way as above but using a smaller total volume of 2 ml with 2% lidocaine.





Aftercare The patient must maintain retraction and depression of the shoulders and avoid elevation of the arm above shoulder level for up to 2 weeks. Taping the shoulder in retraction/depression for a few days, with postural advice, is helpful. When pain free, the patient commences resisted lateral rotation and retraction exercises, followed by strengthening of abduction. Retraining of over arm activities to avoid recurrence is essential.

SUBSCAPULARIS BURSA AND TENDON

Acute or chronic tendinopathy or bursitis

Causes and findings

- Overuse or trauma: haemorrhagic bursitis can follow a direct blow to the shoulder
- Pain in deltoid area or anterior to shoulder
- Painful: resisted medial rotation
  arc on active abduction
  full passive horizontal adduction (scarf test)

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
Bursa 2 ml Tendon 1 ml	Blue 23G 1.25″ (30 mm)	Bursa 20 mg Tendon 10 mg	Bursa 1.5 ml 2% Tendon 0.75 ml 2%	Bursa 2 ml Tendon 1 ml

Anatomy

The subscapularis tendon inserts into the medial edge of the lesser tuberosity of the humerus. It is approximately two fingers wide at its teno-osseous insertion and is a thin, fibrous structure feeling bony to palpation.

The subscapularis bursa lies deep to the tendon in front of the neck of the scapula and usually communicates with the joint capsule of the shoulder. It is invariably extremely tender to palpation even when not inflamed.

Technique

- Patient sits supported with arm by side and held in 45° lateral rotation
- Identify the coracoid process. Move laterally to feel small protuberance of lesser tuberosity by passively rotating arm. Mark medial aspect of tuberosity
- Insert needle at this point, angling slightly laterally and touching bone at insertion for tendon, or in sagittal plane through tendon to enter the bursa
- Pepper solution into tendon insertion, or as a bolus deep to tendon into bursa

Comments

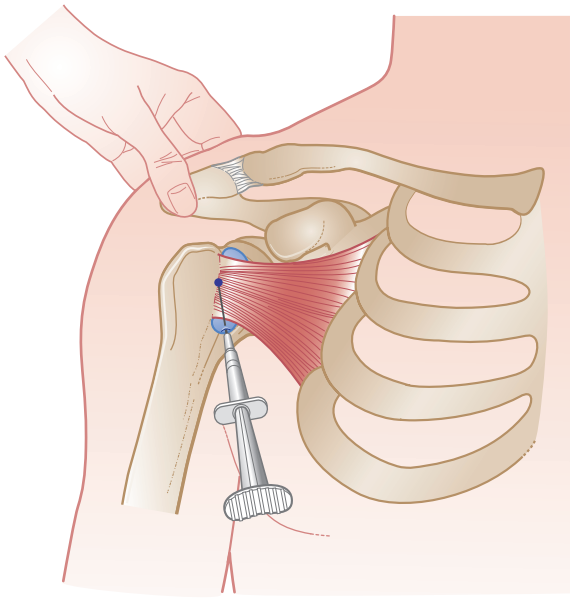
Subscapularis bursitis and tendinitis are often difficult to differentiate. The bursa is implicated if there is more pain on the scarf test than on resisted medial rotation, and if there is even more than usual tenderness to palpation.

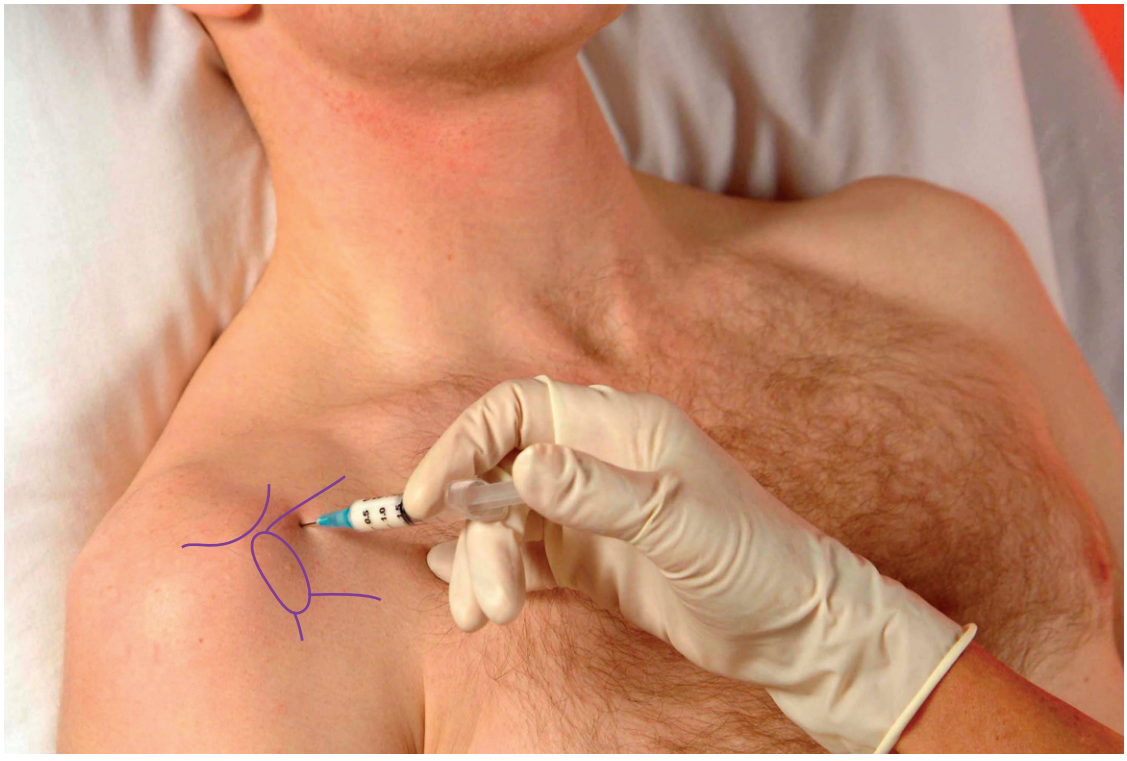
Alternative approaches

If the bursa and tendon are inflamed together they can both be infiltrated at the same time by peppering the tendon first and then going through it to infiltrate the bursa. The total dose is increased to 30mg in total volume of 3 ml.

Aftercare

Relative rest for a week is advised, then progressive stretching and strengthening programme when pain-free. In sporting overuse injuries the cause should also be addressed.





BICEPS – LONG HEAD

Chronic tendinopathy

Causes and findings

- Overuse
- Pain anterior top of humerus
- Painful: resisted elbow flexion with supination
  passive shoulder extension
  occasional arc on elevation

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Blue 23G 1–1.25″ (25–30 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The long head of biceps lies within a sheath in the bicipital groove between the greater and lesser tuberosities. It can be palpated by getting the patient to contract the muscle under the palpating finger in the groove.

Technique

- Patient sits with supported elbow held at right angle
- Identify tender area of tendon
- Insert needle perpendicular to skin at highest part of tenderness, then angle downwards parallel to tendon
- Inject solution as a bolus between tendon and sheath

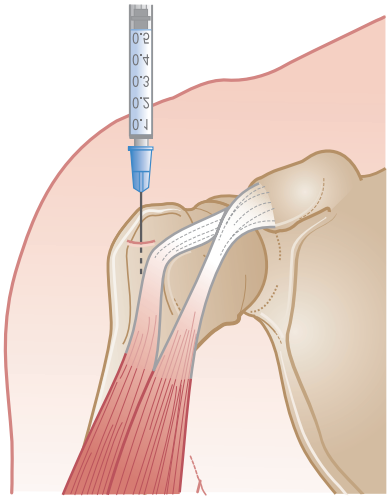
Comments

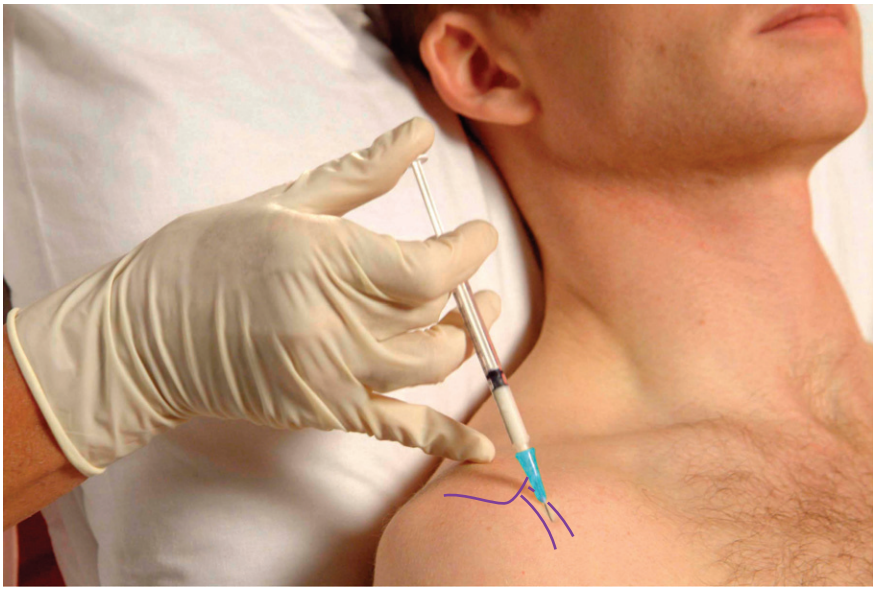
This lesion is commonly diagnosed but, in our experience, is quite rare. Palpation of what is normally a tender area can lead to a misdiagnosis of this tendinopathy, when it might be pain referred from the cervical spine, shoulder joint or rotator cuff lesion.

If there is a sudden onset of pain on flexing, a distinct bulge can appear mid-humerus, indicating rupture of the long head of biceps. After the pain has subsided the patient is usually able to function normally because the short head is sufficient to take over flexion activities.

Aftercare

Advise relative rest for a week then address the causes of the lesion.





INFRASPINATUS TENDON

Chronic tendinopathy

Cause and findings

- Overuse
- Pain in deltoid area
- Painful: resisted lateral rotation
  arc on active abduction

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The infraspinatus and teres minor tendons insert together into the middle and lower facets on the posterior aspect of the greater tuberosity of the humerus. Placing the arm in 90° of flexion, full adduction and lateral rotation brings the tendons out from under the thickest portion of the deltoid and puts them under tension. The tendons run obliquely upwards and laterally and are, together, approximately three fingers wide at the teno-osseous insertion.

Technique

- Patient sits or lies with supported arm flexed to right angle and held in full adduction and lateral rotation
- Identify posterior angle of acromion. Tendon insertion now lies 45° inferior and lateral in direct line with lateral epicondyle of the elbow
- Insert needle at mid-point of tendon at insertion. Pass through tendon and touch bone
- Pepper solution perpendicularly in two rows up and down into teno-osseous junction

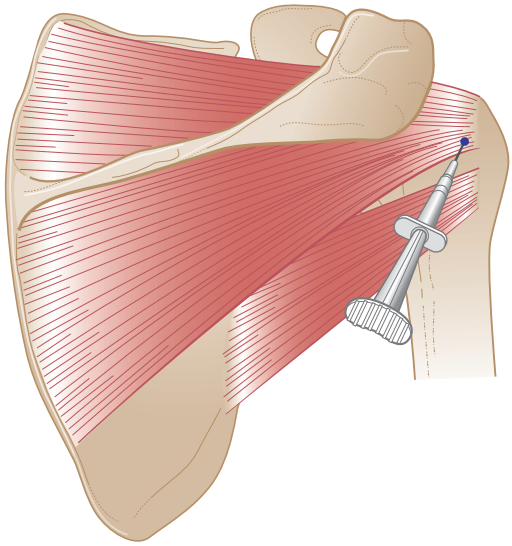
Alternative approaches

Usually a painful arc is present which indicates that the lesion lies at the teno-osseous junction. Occasionally there is no arc, when the lesion lies more in the body of the tendon. In this case, the needle is inserted more medially where there is often an area of tenderness. The same technique is applied.

This lesion might occur in conjunction with subacromial bursitis. If there is a possibility of a double lesion, inject the bursa first and the tendon later if symptoms persist.

Aftercare

Relative rest is advised for up to two weeks. A progressive exercise and postural correction regimen is begun when symptom-free.



SUPRASPINATUS TENDON

Chronic tendinopathy

Cause and findings

- Overuse
- Pain in deltoid area
- Painful: resisted abduction
  arc on active abduction

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The supraspinatus tendon inserts into the superior facet on the greater tuberosity of the humerus, which lies in a direct line with the lateral epicondyle of the elbow. A line joining the two points passes through the tendon, which is approximately the size of the middle finger at insertion.

Technique

- Patient sits supported at 45° with forearm medially rotated behind back, bringing the tendon forward so it lies just anterior to the edge of the acromion
- Identify rounded tendon in the hollow between acromion and tuberosity, in direct line with the lateral epicondyle
- Insert needle perpendicularly through tendon to touch bone
- Pepper solution perpendicularly into tendon

Comments

There is much controversy about injecting tendons because of the possibility of rupture. If the patient is elderly and the cause is traumatic, an ultrasound scan should be performed to determine if there is a tear in the tendon. Deep friction and a muscle balancing regime may then be the better treatment but surgery may be advised in some cases.

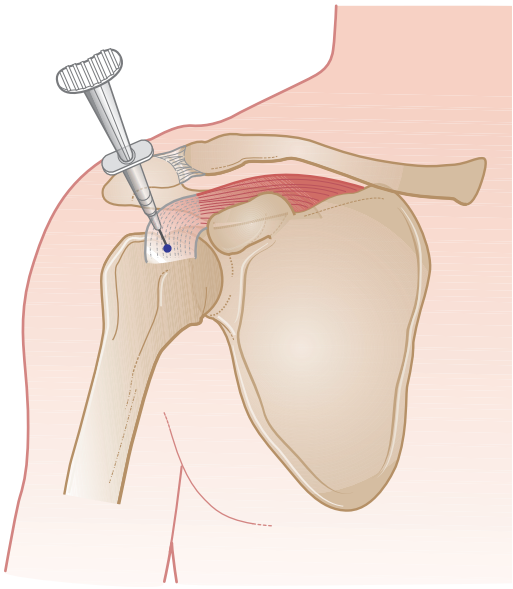
Alternative approaches

Supraspinatus tendinopathy can occur on its own but is often associated with subacromial bursitis. If there is doubt about the existence of a double lesion, the bursa should be injected first. If some pain remains on resisted abduction, then the tendon can be infiltrated a week or so later.

Calcification can arise within the tendon and a hard resistance would then be felt with the needle. It is worth attempting to break up the calcification with a large-bore needle and local anaesthetic. The results are variable. If symptoms persist a surgical opinion should be sought.

Aftercare

Relative rest is advised for up to 2 weeks. A progressive exercise and postural control regimen is begun when symptom-free.



SUPRASCAPULAR NERVE

In acute or chronic capsulitis of the glenohumeral joint

Causes and findings

- Trauma, osteoarthritis or rheumatoid arthritis causing 'frozen shoulder'
- Pain in deltoid area possibly radiating down to hand in severe cases
- Painful and limited: capsular pattern – most loss of lateral rotation with hard endfeel

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Green 21G 1.75″ (40 mm)	20 mg	Nil	0.5 ml

Anatomy

The suprascapular nerve passes through the suprascapular notch into the supraspinous fossa, runs laterally to curl around the neck of the spine of the scapula and ends in the infraspinous fossa. It supplies the supraspinatus and infraspinatus, and sends articular branches to the shoulder and acromioclavicular joints.

Technique

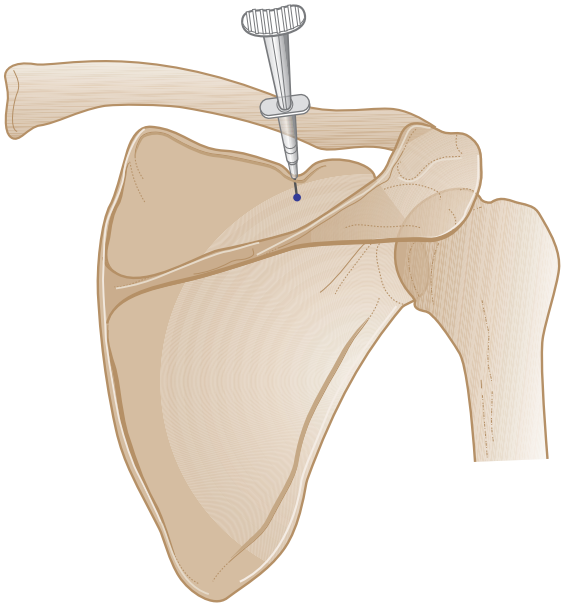
- The patient sits supported with arm in neutral position
- Identify lateral end of spine of scapula, move one-third along medially and mark a spot one finger superiorly in suprascapular fossa
- Insert needle perpendicular to fossa and touch bone
- Inject solution as a bolus

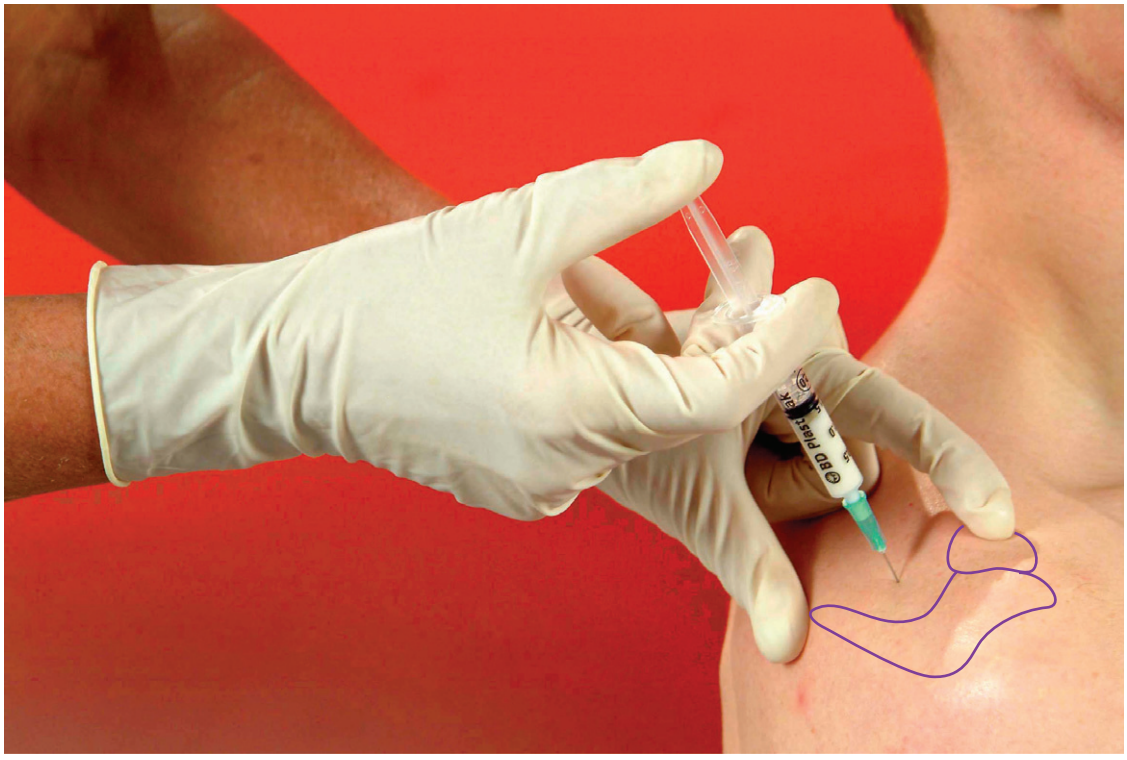
Comments

It is worth trying an injection here when intracapsular injections for shoulder capsulitis have not been successful. A small randomized trial suggests that suprascapular nerve block is a safe and effective alternative treatment for frozen shoulder in primary care[41]. Some clinicians advise the use of a longer-lasting anaesthetic alone or with corticosteroid. This injection might also be useful in patients with rotator cuff tears who are not fit for surgery. Symptoms of paraesthesia or burning when placing the needle indicate that it is within the nerve. Withdraw slightly before injecting.

Aftercare

Mobility at the shoulder is maintained within pain-free range. Stretching and mobilization are started when pain permits.




BD Plastipak

ELBOW JOINT

Acute or chronic capsulitis

Causes and findings

- Degenerative, inflammatory or traumatic arthropathies; occasionally overuse
- Pain in and around elbow joint
- Painful and limited: capsular pattern – more loss of flexion than extension with hard endfeel

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2.5 ml	Blue 23G 1.25″ (30 mm)	30 mg	1.75 ml 2%	2.5 ml

Anatomy

The capsule of the elbow joint contains all three articulations – the radiohumeral, radioulnar and humeroulnar joints. The posterior approach into the small gap between the top of the head of the radius and the capitulum of the humerus is the safest and easiest.

Technique

- Patient sits with elbow supported in pronation at 45° of flexion
- Identify gap of joint line above head of radius posteriorly by passively moving elbow into flexion and extension
- Insert needle at mid-point of joint line parallel to the top of the head of radius, and penetrate capsule
- Inject solution as a bolus

Comments

This is not a very common injection but may be useful after trauma or fracture of the radial head.

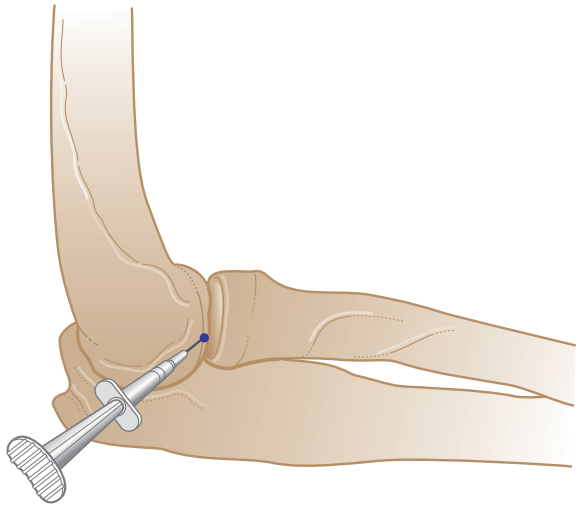
If the cause of the symptoms is one or more loose bodies within the joint, the treatment is mobilization under strong traction. If the range is improved by this but the pain persists, an injection may be considered. Adolescents with loose bodies in the joint should be referred for surgical removal.

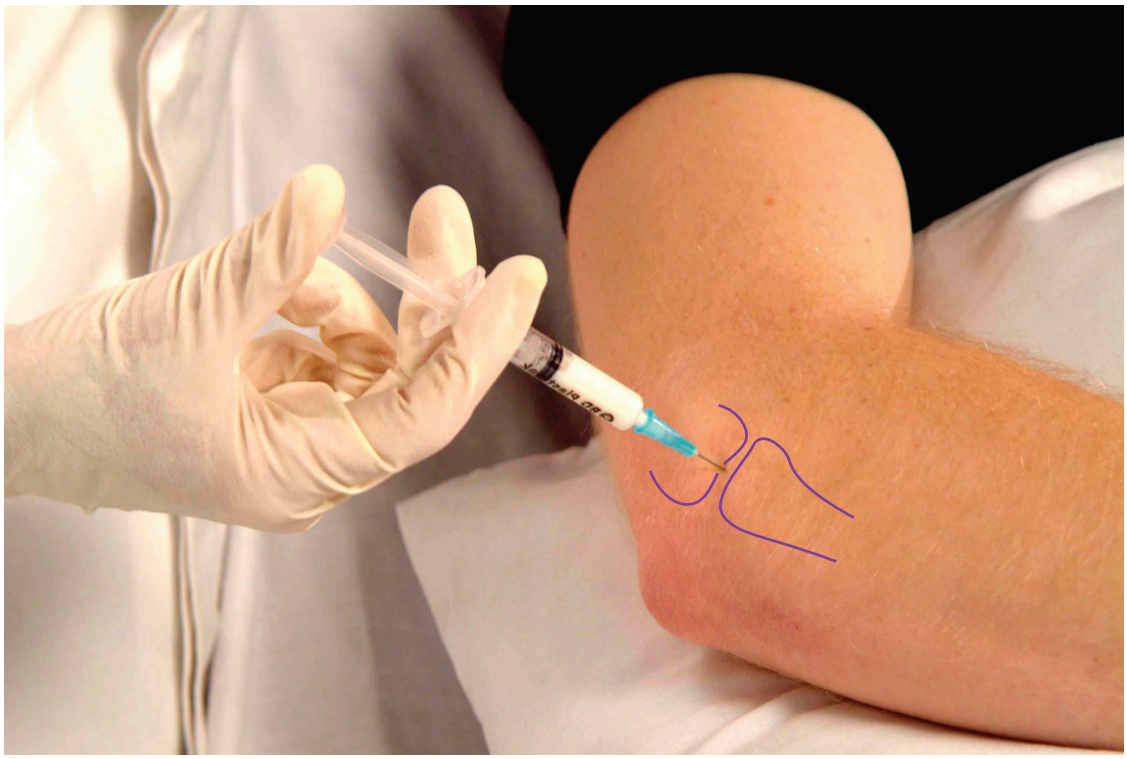
Alternative approaches

If the joint is very degenerated, osteophytosis might be present around the joint margin, making entry with the needle more difficult. Deposition of a small amount of the solution into the capsule enables the clinician to 'walk' around the joint line with minimal discomfort to the patient. Some clinicians favour the posterior approach to the joint, inserting the needle at the top of the olecranon and angling obliquely distally.

Aftercare

After a couple of days the patient should start increasing range of motion within the limits of pain using gentle stretching movements, especially into flexion. Passive mobilization techniques are effective in achieving full range but should be given with care in order not to further traumatize the joint.





BICEPS BURSA AND TENDON INSERTION

Chronic tendinopathy or bursitis

Causes and findings

- Overuse
- Pain at front of elbow
- Painful: resisted flexion and supination of elbow, full passive flexion, extension and pronation of elbow if bursa affected – a 'muddle' of signs

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
Tendon 1 ml Bursa 2 ml	Blue 23G 1″ (25 mm)	Tendon 10 mg Bursa 20 mg	Tendon 0.75 ml 2% Bursa 1.5 ml 2%	Tendon 1 ml Bursa 2 ml

Anatomy

Although the biceps can be affected at any point along its length, the insertion into the radial tuberosity on the anteromedial aspect of the shaft of the radius is particularly vulnerable. A small bursa lies at this point and can be inflamed together with the tendon or on its own. The insertion of the biceps is identified by following the path of the tendon distal to the cubital crease while the patient resists elbow flexion. The patient then relaxes the muscle and the tuberosity can be palpated on the ulnar side of the radius while passively pronating and supinating the forearm. The site is always very tender to palpation, even in the normal elbow.

Technique

- Patient lies face down with arm extended and palm flat on table. Fix humerus on table and passively fully pronate forearm. This brings the radial tuberosity round to face posteriorly
- Identify radial tuberosity two fingers distal to radial head
- Insert needle perpendicularly to touch bone
- Pepper solution into tendon or bolus into bursa, or both, as necessary

Comments

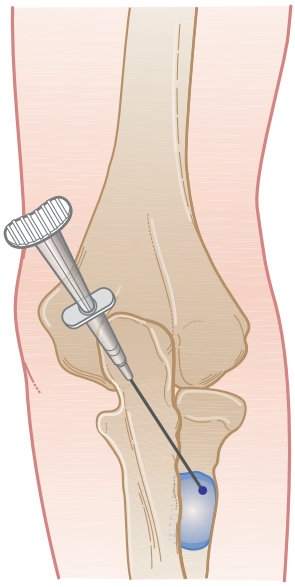
Differentiation between bursitis and tendonopathy is often difficult. If there is more pain on passive flexion and pronation of the elbow than on resisted flexion, together with extreme sensitivity to palpation, the bursa is more suspect.

Alternative approaches

If a double lesion is suspected, infiltrate the bursa first and reassess 1 week later. The tendon can then be injected if necessary.

Aftercare

Rest for a week before beginning graded strengthening and stretching routine, followed by addressing the cause of the overuse.



OLECRANON BURSA

Acute or chronic bursitis

Causes and findings

- Sustained compression or direct blow; rheumatoid arthritis or gout; infection
- Pain at posterior aspect of elbow joint often with obvious swelling
- Painful: passive flexion and sometimes extension
  resisted extension occasionally

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1″ (25 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The bursa lies subcutaneously at the posterior aspect of the elbow and is approximately the size of a golf ball.

Technique

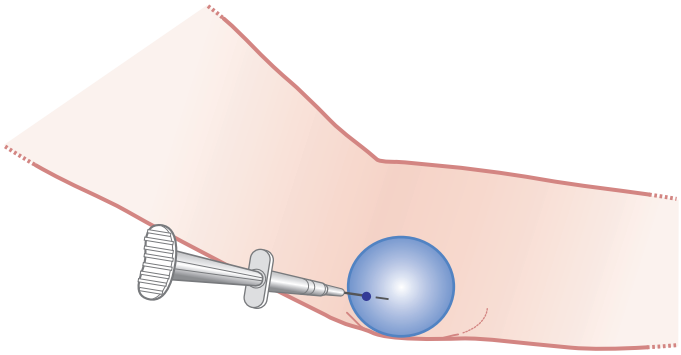
- Patient sits with supported elbow at right angle
- Identify centre of tender area of bursa
- Insert needle into this point
- Inject solution as a bolus

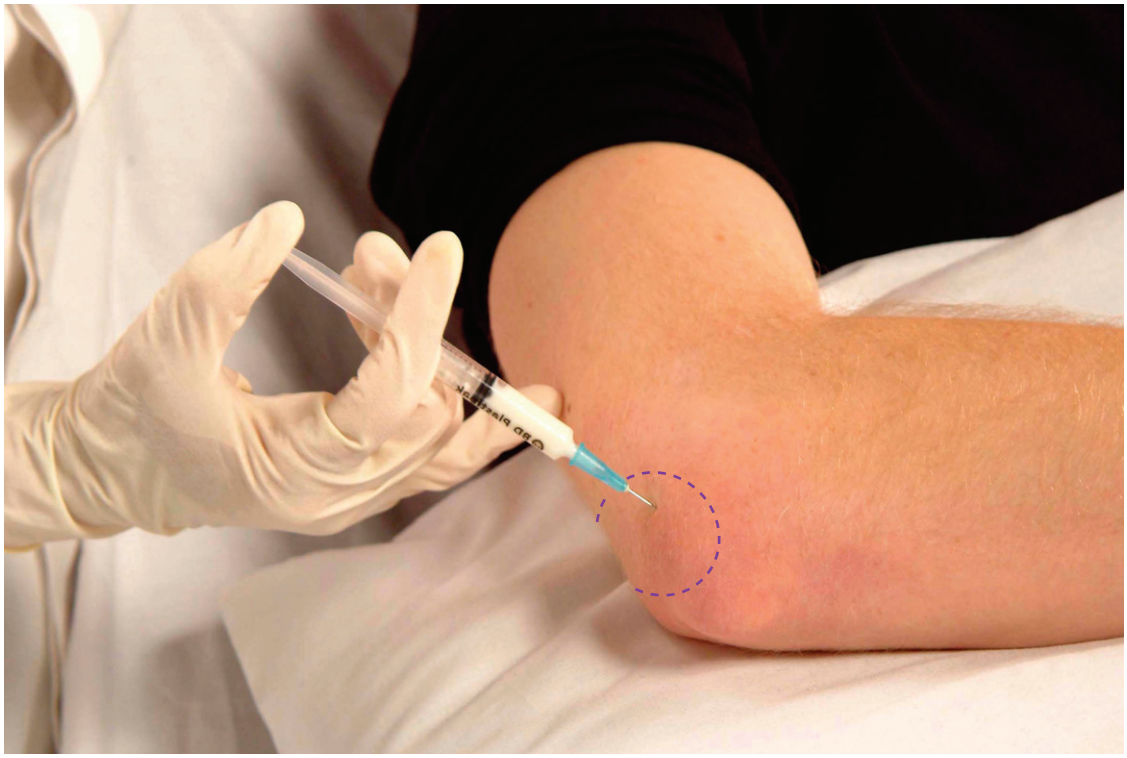
Comments

If swelling is present, always aspirate first. If suspicious fluid is withdrawn, infiltration should not be given until the aspirate has been investigated. Occasionally a direct blow or fall can cause haemorrhagic bursitis. In these cases, the treatment should be immediate aspiration of all blood prior to infiltration.

Aftercare

Advise relative rest for a week, then resumption of normal activities avoiding leaning on elbow.





COMMON EXTENSOR TENDON

Chronic tendinopathy – 'tennis elbow'

Causes and findings

- Overuse
- Pain at lateral aspect of elbow aggravated by gripping and twisting
- Painful: resisted extension of wrist with elbow extended
  passive wrist flexion with ulnar deviation

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5" (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

Tennis elbow invariably occurs at the teno-osseous origin, or enthesis, of the common extensor tendon at the elbow. The tendon arises from the anterior facet of the lateral epicondyle, which is approximately the size of the little finger nail.

Technique

- Patient sits with supported elbow at right angle and forearm supinated
- Identify lateral point of epicondyle then move anteriorly onto facet
- Insert needle in line with cubital crease perpendicular to the facet to touch bone
- Pepper solution into tendon enthesis

Comments

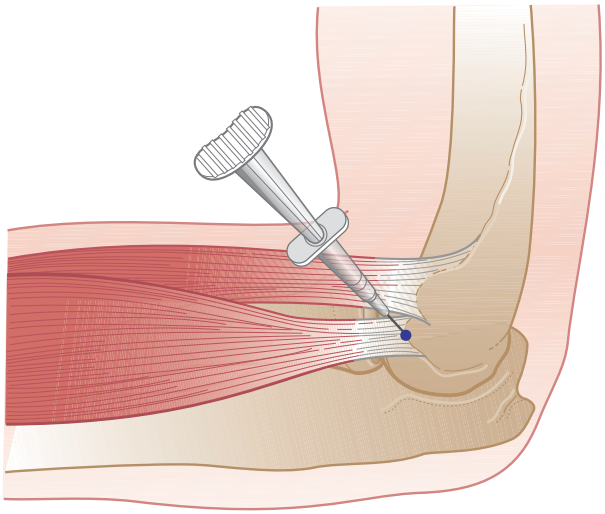
This is a very common injectable lesion. Although the teno-osseous junction is the most usual site, the lesion can occur in the body of the tendon, in the muscle belly and at the origin of the extensor carpi radialis longus. Ignore tender trigger points in the body of the tendon, present in everyone, and place the needle exactly at the very small site of the lesion. 'Repetitive strain injury' can include true tennis elbow but neural stretching, relaxation techniques, cervical mobilization and postural advice might be effective if the tendon is clear. One injection usually suffices but, if symptoms recur, a second injection can be given followed by the above routine ten days later.

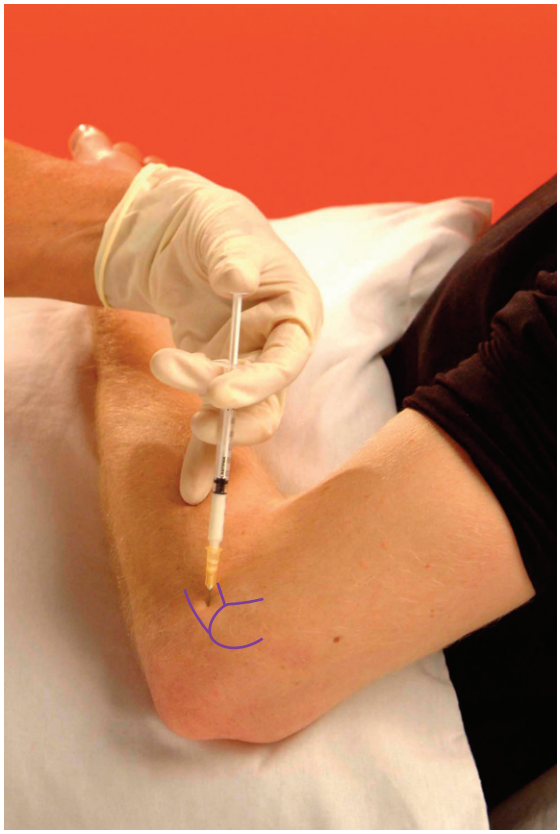
Alternative approaches

Sclerosant injection can be used, or tenotomy may be performed on the recurrent tendon. Depigmentation and/or subcutaneous atrophy can occur in thin patients, especially those with dark skins, and they should be informed of this before giving consent. Hydrocortisone should be used if the patient is concerned about these possible side-effects.

Aftercare

The patient rests the elbow for 10 days. Any lifting must be done only with the palm facing upwards so that the flexors rather than the extensors are used; the causal activity must be avoided. When resisted extension is pain-free, two or three sessions of deep friction with a strong extension manipulation (Mill's manipulation) are given to prevent recurrence. Stretching of the extensors and a strengthening programme is then gradually introduced. If the cause was a racket sport, the weight, handle-size and stringing of the racket should be checked; as should the technique. Continuous static positions at work should be avoided.





COMMON FLEXOR TENDON

Chronic tendinitis – 'golfer's elbow'

Causes and findings

- Overuse
- Pain at medial aspect of elbow aggravated by gripping and lifting
- Painful: resisted flexion of wrist
  occasionally resisted pronation of forearm

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5" (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The common flexor tendon at the elbow arises from the anterior facet on the medial epicondyle. It is approximately the size of the little finger nail at its teno-osseous origin.

Technique

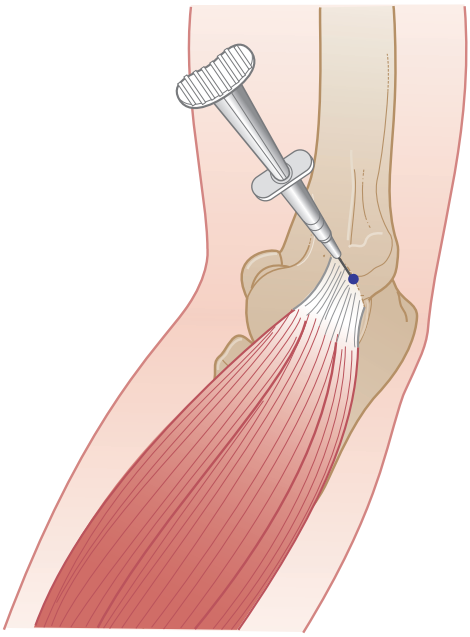
- Patient sits with supported arm extended
- Identify facet lying anteriorly on medial epicondyle
- Insert needle perpendicular to facet and touch bone
- Pepper solution into tendon

Comments

Occasionally the lesion occurs at the musculotendinous junction, which is invariably a very tender point. Infiltration at this point might not be as effective but deep friction can be successful. This lesion is not as common as tennis elbow and less prone to recurrence, so follow-up treatment of deep friction and manipulation do not seem to be necessary.

Aftercare

Relative rest for a week, then stretching and strengthening exercises can be started.



INFERIOR RADIOULNAR JOINT AND TRIANGULAR MENISCUS

Chronic capsulitis or acute tear of the meniscus

Causes and findings

- Osteoarthritis or rheumatoid arthritis; trauma: fall on outstretched hand or strong traction
- Pain on ulnar side of wrist
- Painful and limited: capsular pattern – passive pronation and supination at end-range
- For meniscal tear: passive and resisted wrist flexion, resisted and passive ulnar deviation, plus 'scoop' test (see below)

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Orange 25G 0.5″ (16 mm)	10 mg	1 ml 2%	1.25 ml

Anatomy

The inferior radioulnar joint is an L-shaped joint about a finger's width in length and includes a triangular cartilage, which separates the ulna from the carpus. With the palm facing downwards, the joint line lies just medial to the bump of the end of the ulna, one-third across the wrist. The joint line is identified by gliding the ends of the radius and ulna against each other or by palpating the space between the styloid process of the ulna and the triquetral.

Technique

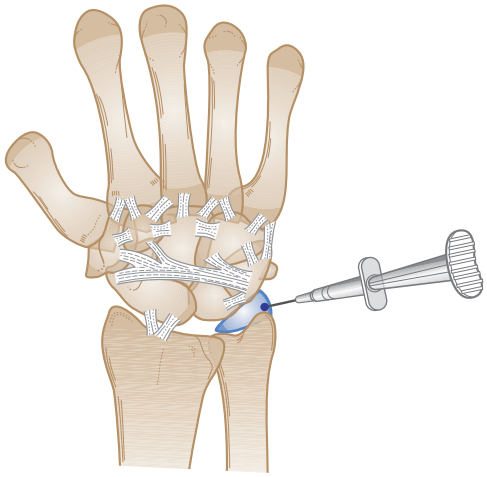
- Patient sits with hand palm down
- Identify styloid process of ulnar
- Insert needle just distal to styloid aiming transversely towards radius, passing through the ulnar collateral ligament to penetrate capsule
- Inject solution as a bolus

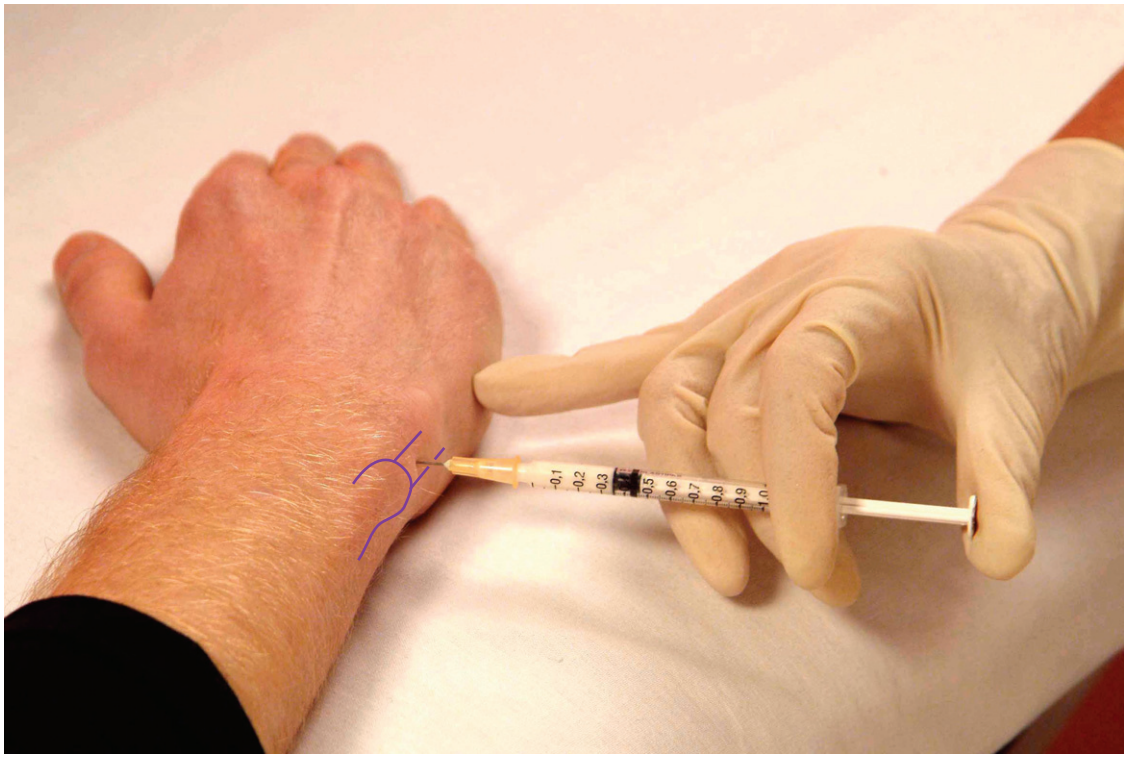
Comments

Tears of the cartilage are relatively common, especially after trauma such as falling on the outstretched hand, a traction injury or after Colles' fracture. The most pain-provoking test is the scoop test – compressing the supinated wrist into ulnar deviation and scooping it in a semi-circular movement towards flexion. The patient often complains of painful clicking and occasionally the wrist locks. Mobilization helps relieve the pain but an injection can be given in the acute phase. Often an explanation of the condition and reassurance, together with advice on avoidance, is sufficient.

Aftercare

Advise rest for a week with avoidance of flexion/ulnar deviation activities. Mobilization with distraction can be effective in meniscal tears.





WRIST JOINT

Acute capsulitis

Causes and findings

- Rheumatoid arthritis; trauma
- Pain in wrist joint. May also be heat, synovial thickening or swelling
- Painful and limited: capsular pattern – passive extension and flexion with hard end feel

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25" (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The wrist joint capsule is not continuous and has septa dividing it into separate compartments. For this reason it cannot be injected at one spot, but requires several areas of infiltration through one injection entry point.

Technique

- Patient places the hand palm down in some degree of wrist flexion
- Identify mid-carpus proximal to hollow dip of capitate
- Insert needle at mid-point of carpus
- Inject at different points across the dorsum of the wrist, both into the ligaments and also intracapsular where possible

Comments

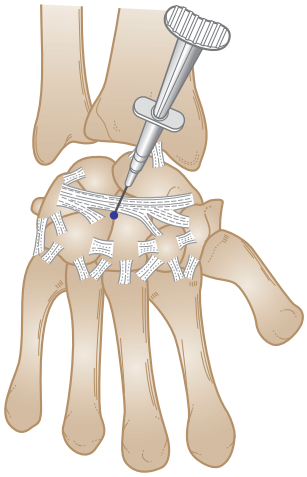
This is a common area for injection in patients with rheumatoid arthritis. Patients with other causes such as trauma, overuse or osteoarthritis usually respond well to a short period of pain-relieving modalities, medication and rest in a splint, followed by passive and active mobilization techniques. As in all cases of trauma, fracture, especially of the scaphoid, should be eliminated.

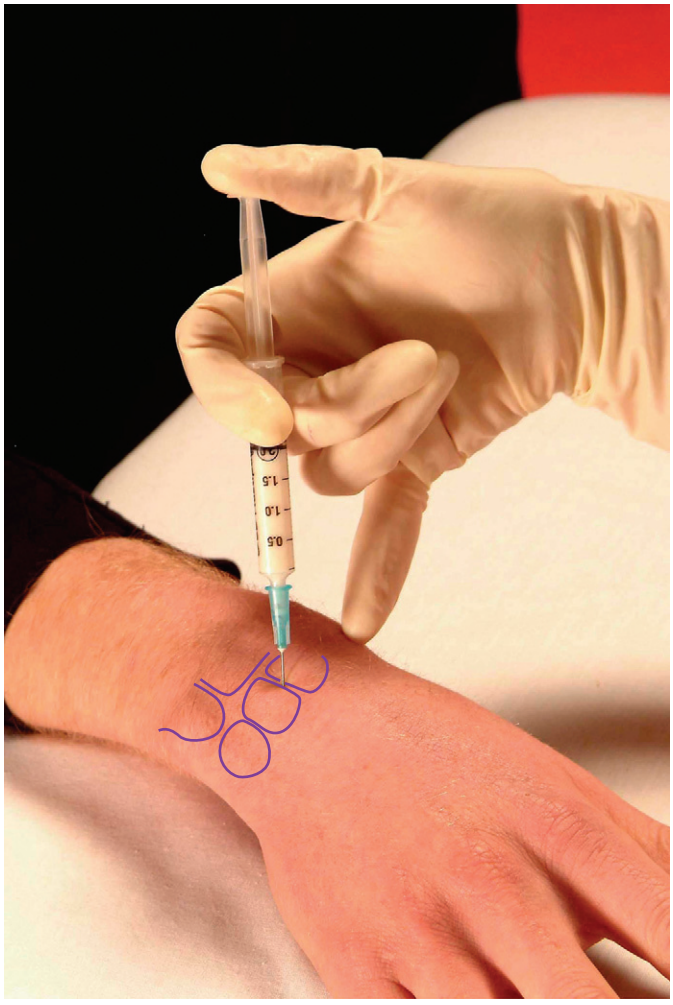
Alternative approaches

If the joint is badly affected and swollen, it might be necessary to use a longer needle to reach all around the area, or to inject at several points.

Aftercare

The patient rests in a splint until the pain subsides and then begins gentle mobilizing exercises within the pain-free range. Wax baths can be most beneficial and the wax can be used as an exercise ball after being peeled off the hands.





THUMB AND FINGER JOINTS

Acute or chronic capsulitis

Causes and findings

- Overuse or trauma; rheumatoid or degenerative arthritis
- Pain over joint line/s
- Thumb: painful and limited capsular pattern
- Fingers: painful and limited capsular patterns

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	Thumb 10 mg Fingers 10 mg	0.75 ml 2% 0.5 ml 2%	1 ml 0.75 ml

Anatomy

The first metacarpal articulates with the trapezium. The easiest entry site is at the apex of the snuff-box on the dorsum of the wrist. The joint line is found by passively flexing and extending the thumb while palpating for the joint space between the two bones. Mark the entry point slightly more proximal to allow for the rounded shape of the base of the metacarpal. Be aware that the radial artery lies at the base of the snuffbox.

The distal thumb joint, and all finger joints can best be infiltrated from the medial or lateral aspect at the joint line with the digit in slight flexion.

Technique

- Patient rests hand in mid position with thumb up and traction is applied by patient
- Identify gap of joint space at apex of snuff box on dorsum of wrist
- Insert needle perpendicularly into gap
- Inject solution as a bolus

Comments

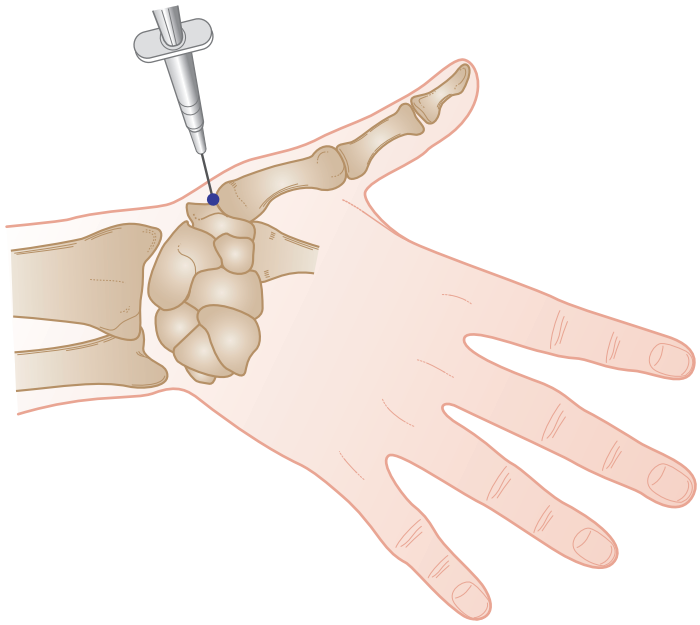
Trapeziometacarpal joint capsulitis is a common lesion of older females and the results of infiltration are uniformly excellent. Often it is several years before a repeat injection is required, provided the patient does not grossly overuse the joint.

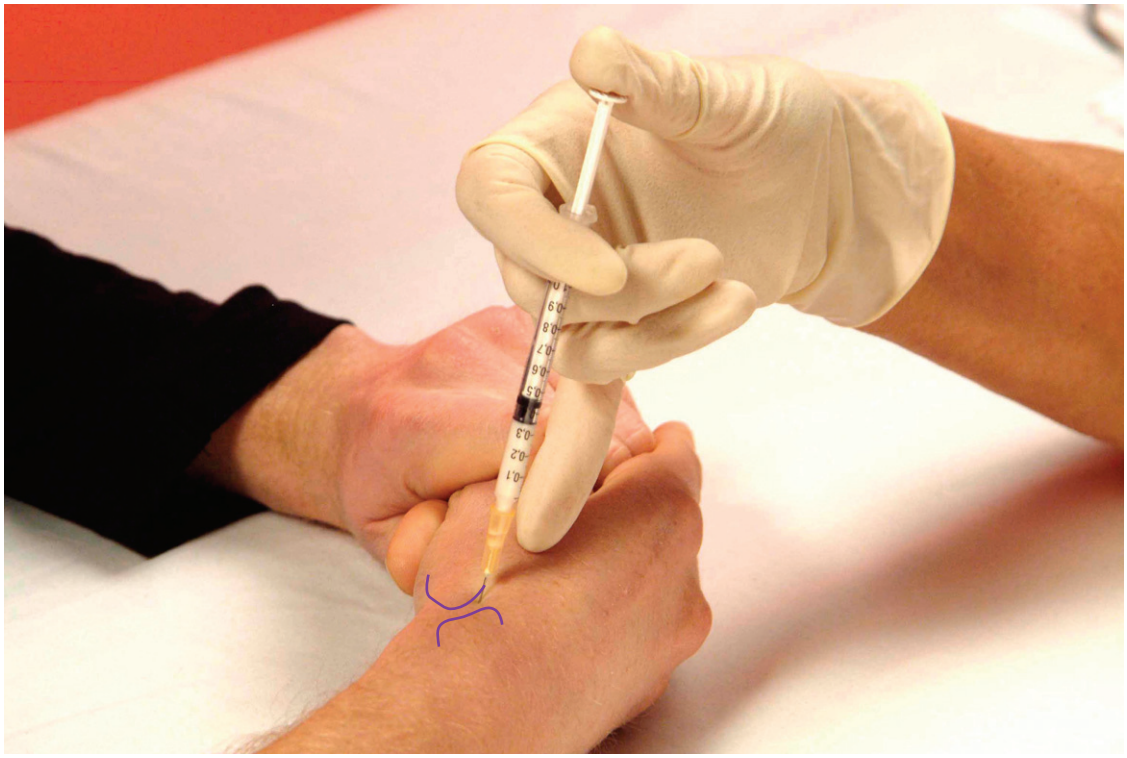
Alternative approaches

Infiltrating the thumb and finger joints can be difficult as osteophytosis will almost certainly be present. It is sometimes necessary to anaesthetize the capsule with some of the solution while trying to enter the joint. Gapping the side of the joint being entered also helps, and an even finer needle, such as 30G, can be used.

Aftercare

Tape the thumb using a spica technique, or tape two fingers together to splint them for a few days. Patient then begins gentle active and passive mobilizing exercise within pain-free range and is advised against overuse of the thumb or fingers. Dipping the fingers into warm wax baths and using the wax ball as an exercise tool can be beneficial.





FLEXOR TENDON NODULE

Trigger finger or trigger thumb

Causes and findings

- Spontaneous onset, often with rheumatoid or osteoarthritis
- Painful clicking and sometimes locking of finger with inability to extend
- A tender nodule can be palpated usually at the base of the finger

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.25 ml 2%	0.5 ml

Anatomy

Trigger finger is caused by enlargement of a nodule within the flexor tendon sheath, which then becomes inflamed and painful. It usually occurs at the joint lines where the tendon is tethered down by the ligaments and can occur in any digit but often in thumb or index finger.

Technique

- Patient places hand palm up
- Identify and mark nodule
- Insert needle perpendicularly into nodule
- Deposit half solution in a bolus into nodule
- Angle needle distally into sheath
- Deposit remaining solution into sheath

Comments

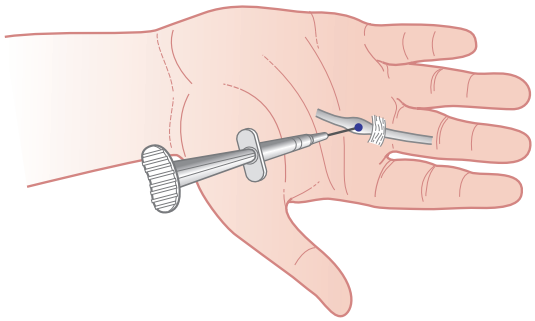
This injection is invariably effective. Although the nodule usually remains, it can continue to be asymptomatic indefinitely, but recurrence can be treated with a further injection. Occasionally a slight pop is felt as the needle penetrates the nodule. When the needle is in a tendon, a rubbery resistance is felt.

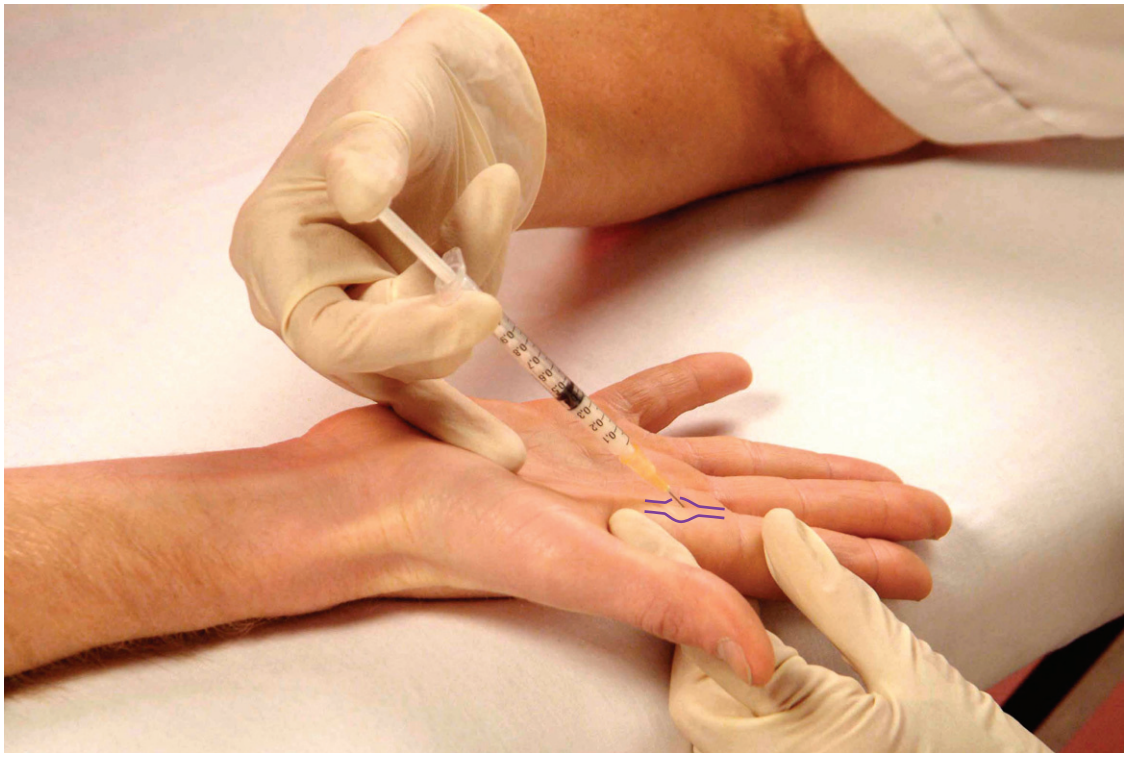
Alternative approaches

Some clinicians insert the needle alone first and then ask the patient to flex the finger. If the needle moves, this proves that the correct site has been reached and the syringe may then be attached. As this involves delay and discomfort to the patient, we recommend the method above.

Aftercare

No particular restriction is placed on the patient's activities except relative rest for a few days.





THUMB TENDONS

de Quervain's tenosynovitis

Causes and findings

- Overuse of abductor pollicis longus and extensor pollicis brevis
- Pain over base of thumb and over styloid process of radius; occasional crepitus
- Painful: resisted abduction and extension of thumb, passive flexion of thumb across palm with wrist in ulnar deviation (Finklestein's test)

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The abductor pollicis longus and extensor pollicis brevis usually run together in a single sheath on the radial side of the wrist. The styloid process is always tender so comparison should be made with the pain-free side. The two tendons can often be seen when the thumb is held in resisted extension, or can be palpated at the base of the metacarpal. The aim is to slide the needle between the two tendons and deposit the solution within the sheath.

Technique

- Patient places hand vertically with thumb held in slight flexion
- Identify gap between the two tendons at base of first metacarpal
- Insert needle perpendicularly into gap then slide proximally between the tendons
- Inject solution as a bolus within tendon sheath

Comments

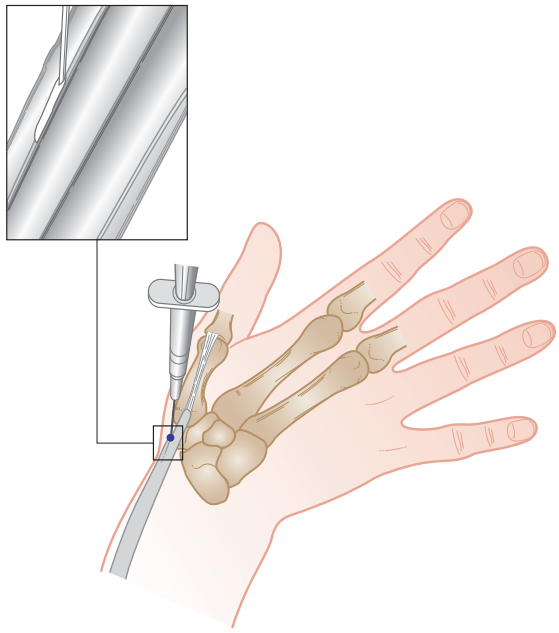
Provided the wrist is not too swollen, a small sausage-shaped swelling can often be seen where the solution distends the tendon sheath.

Alternative approaches

This is an area where depigmentation or subcutaneous fat atrophy can occur, especially noticeable in dark-skinned thin females. Although recovery can take place, the results might be permanent. Patient should be warned of this possibility before giving their consent. The potential risk can be minimized by injecting with hydrocortisone.

Aftercare

The patient should rest the hand for a week with taping of the tendons. This is followed by avoidance of the provoking activity and a graded strengthening regime if necessary.



CARPAL TUNNEL

Median nerve compression under flexor retinaculum

Causes and findings

- Overuse or trauma, post-Colles' fracture; pregnancy, hypothyroidism, acromegaly; rheumatoid or psoriatic arthropathy; idiopathic
- Pins and needles in the distribution of the median nerve, especially at night
- Paraesthesia with tapping the median nerve at wrist (Tinel's sign) or fully flexing wrist for 30 seconds and then releasing (Phalen's sign). Longstanding nerve compression may cause flattening of thenar eminence and weakness of thumb muscles

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Blue 23G 1.25" (30 mm)	20 mg	Nil	0.5 ml

Anatomy

The flexor retinaculum of the wrist attaches to four sites: the pisiform and the scaphoid, the hook of hamate and the trapezium. It is approximately as wide as the thumb from proximal to distal and the proximal edge lies at the distal wrist crease.

The median nerve usually lies immediately under the palmaris longus tendon at the mid-point of the wrist, and medial to the flexor carpi radialis tendon. Not every patient will have a palmaris longus so ask the patient to press tip of thumb onto tip of little finger; the crease seen at mid-point of the palm points to where the median nerve should run.

Technique

- Patient places hand palm up
- Identify point midway along proximal wrist crease, between flexor carpi radialis and median nerve
- Insert needle at this point then angle it 45°. Slide distally until needle end lies under mid-point of retinaculum
- Inject solution in bolus

Comments

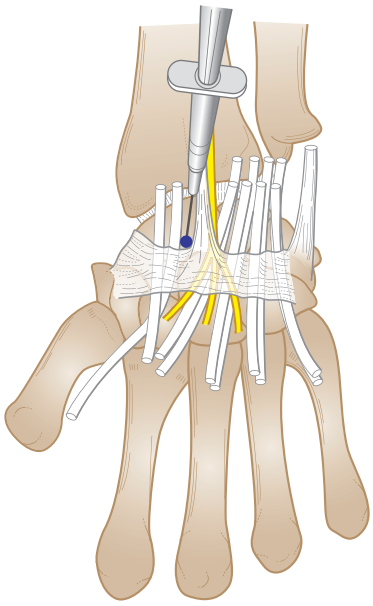
No local anaesthetic is used here because the main symptom is paraesthesia, not pain, and it is not advisable to increase the pressure within the tunnel. Care should be taken to avoid inserting the needle too vertically, when it will go into bone, or too horizontally, when it will enter the retinaculum. If the patient experiences pins and needles, the needle is in the median nerve and must be withdrawn slightly and repositioned. Although one injection is often successful, recurrences do occur. Further injections can be given if some relief was obtained, but if the symptoms still recur surgery may be required.

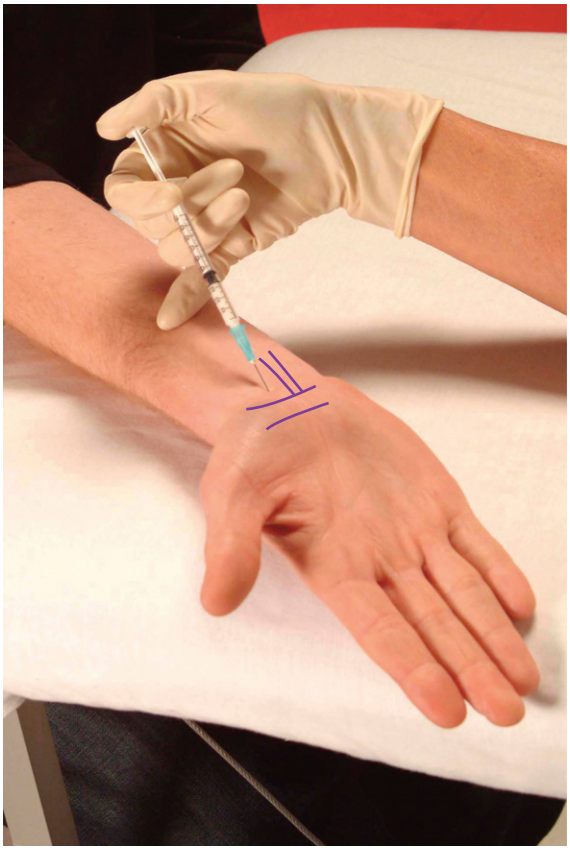
Alternative approach

The injection can be equally well performed by inserting the needle between the median nerve and the flexor tendons, using the same dose and volume.

Aftercare

The patient rests for 1 week and then resumes normal activities. A night splint helps in the early stages after the infiltration and the patient is advised to avoid sleeping with the wrists held in full flexion – the 'dormouse' position.





TEMPOROMANDIBULAR JOINT

Acute or chronic capsulitis

Causes and findings

- Osteoarthritis, poor jaw alignment, nocturnal teeth grinding, trauma e.g. after car accident
- Pain over joint line, headaches
- Pain on eating especially hard or large foods, clicking or locking
- Painful: opening, deviation or protrusion of jaw with asymmetry of movement

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The temporomandibular joint space can be palpated just in front of the ear as the patient opens and closes the mouth. A meniscus lies within the joint and the needle must be placed below this to enter the joint space. The joint can be infiltrated most easily when the jaw is held wide open. Occasionally the meniscus is torn during trauma.

Technique

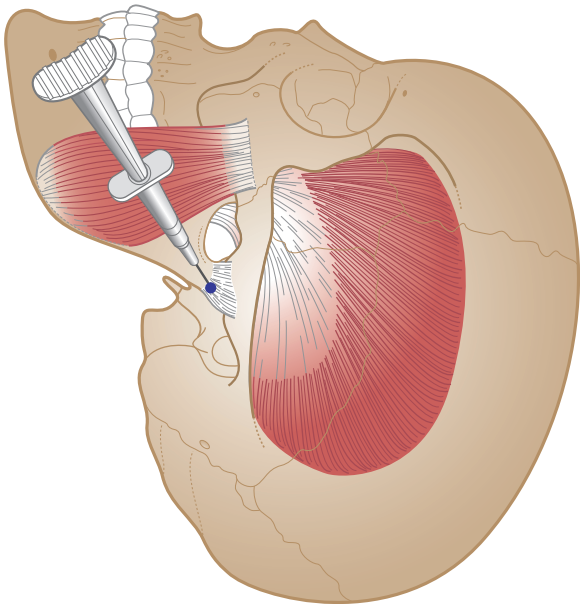
- Patient lies on unaffected side with head supported and mouth held open
- Identify and mark joint space
- Insert needle vertically into inferior compartment of joint space below meniscus
- Inject solution as a bolus

Comments

It might be necessary to manoeuvre the needle about to avoid the meniscus. If the meniscus is displaced, reduction by manipulation should be attempted about 1 week after giving the injection when the inflammation has subsided. In resistant cases surgery may be necessary.

Aftercare

The patient should avoid excessive movement of the jaw such as biting on a large apple or hard food. Gentle active movements and isometric exercises are carried out. A guard to prevent grinding the teeth at night and/or the advice of an orthodontist might be helpful.



SUMMARY OF SUGGESTED UPPER LIMB DOSAGES

Area	Syringe	Needle	Kenalog	Lidocaine	Total volume
Shoulder					
Glenohumeral joint	5 ml	Green 1.5″	40 mg	4 ml 1%	5 ml
Acromioclavicular joint	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Sternoclavicular joint	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Subacromial bursa	5 ml	Blue 1.25–1.5″	20 mg	4.5 ml 1%	5 ml
Subscapularis bursa	2 ml	Blue 1.25–1.5″	20 mg	1.5 ml 2%	2 ml
Subscapularis tendon	1 ml	Blue 1.25–1.5″	10 mg	0.75 ml 2%	1 ml
Biceps long head	1 ml	Blue 1–1.25″	10 mg	0.75 ml 2%	1 ml
Infraspinatus tendon	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Supraspinatus tendon	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Suprascapular nerve	1 ml	Green 1.75″	20 mg	Nil	0.5 ml
Elbow					
Elbow joint	2.5 ml	Blue 1.25″	30 mg	1.75 ml 2%	2.5 ml
Biceps tendon	1 ml	Blue 1.25″	10 mg	0.75 ml 2%	1 ml
Biceps bursa	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Olecranon bursa	2 ml	Blue 1″	20 mg	1.5 ml 2%	2 ml
Common extensor tendon	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Common flexor tendon	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Hand					
Inferior radioulnar joint	2 ml	Orange 0.5″	10 mg	1 ml 2%	1.25 ml
Wrist joint	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Thumb joints	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Finger joints	1 ml	Orange 0.5″	10 mg	0.5 ml 2%	0.75 ml
Flexor tendon nodule	1 ml	Orange 0.5″	10 mg	0.25 ml 2%	0.5 ml
Thumb tendons	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Carpal tunnel	1 ml	Blue 1.25″	20 mg	Nil	0.5 ml
Temporomandibular joint	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml

SECTION 4

LOWER LIMB INJECTIONS

EXAMINATION OF THE LOWER LIMB

The **capsular pattern** is a set pattern of loss of motion for each joint. It indicates that there is some degree of joint capsulitis caused by degeneration, inflammation or trauma. There may be a hard endfeel in advanced capsulitis

Hip tests

In supine

Passive lateral rotation
medial rotation
flexion
abduction
adduction

Resisted flexion
abduction
adduction

In prone

Passive extension
Resisted lateral rotation
medial rotation
knee extension

Hip capsular pattern: most loss of *medial rotation*, less of *flexion* and *abduction*, least of *extension*

Knee tests

Passive flexion
extension
valgus
varus
rotation
medial rotation

Draw test
Glide test
Meniscal tests
Resisted extension
flexion

Knee capsular pattern: more loss of *flexion* than *extension*

Ankle and foot tests

Ankle

Passive dorsiflexion
plantarflexion
eversion
inversion

Resisted dorsiflexion
plantarflexion
eversion
inversion

Subtalar

Passive abduction
adduction

Forefoot

Passive abduction
adduction
extension
flexion

Ankle/foot capsular patterns:
Ankle: More loss of *plantarflexion* than *dorsiflexion*
Subtalar joint: More loss of *adduction*
Forefoot: Loss of *adduction, dorsiflexion and supination*
Big toe: More loss of *extension* than *flexion*
Toes: More loss of *flexion* than *extension*

SECTION 4

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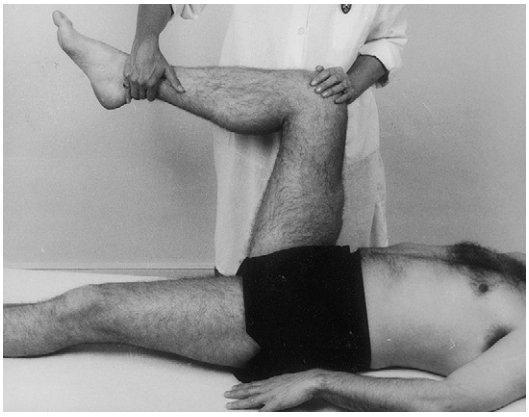
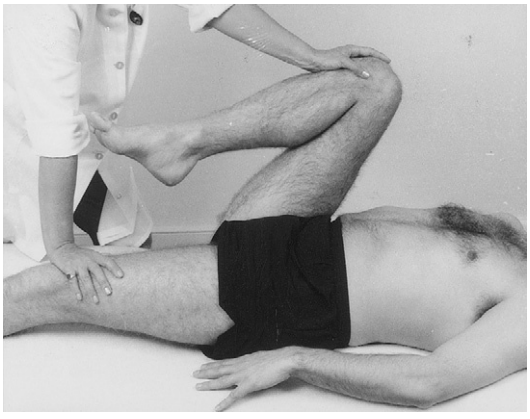
Hip Examination – In Supine

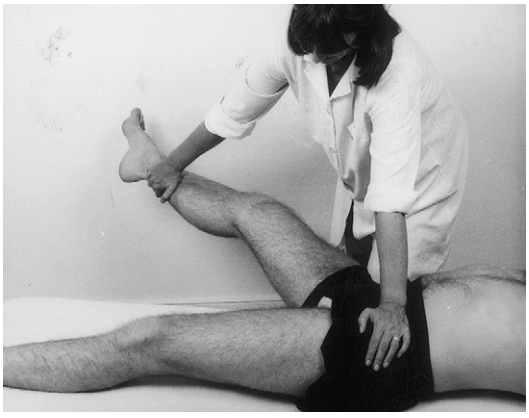
1. Passive lateral rotation



2. Passive medial rotation

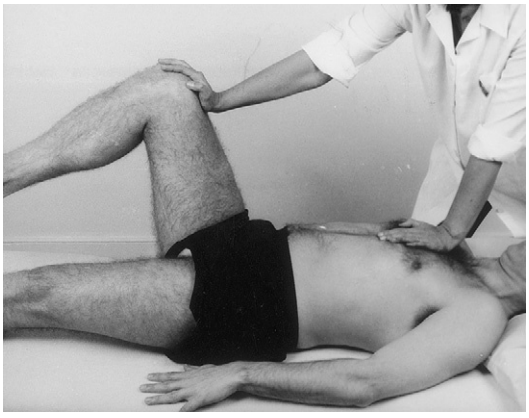


3. Passive flexion



4. Passive abduction

5. Passive adduction



6. Resisted flexion

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7. Resisted abduction

8. Resisted adduction

Hip Examination – In Prone

9. Passive extension

10. Resisted lateral rotation

11. Resisted medial rotation

12. Resisted knee extension

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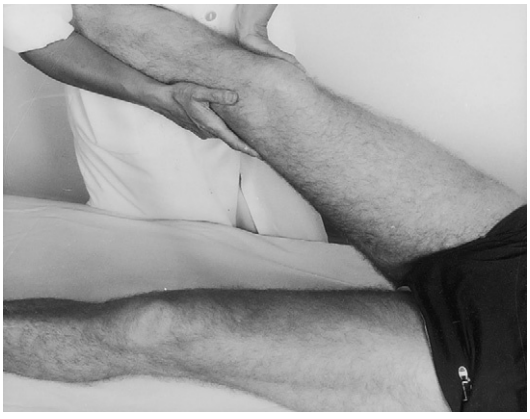
Knee Examination

1. Passive flexion

2. Passive extension



3. Passive valgus

4. Passive varus

5. Passive lateral rotation

6. Passive medial rotation

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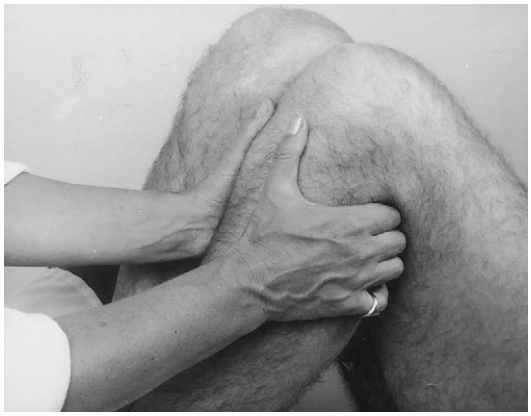
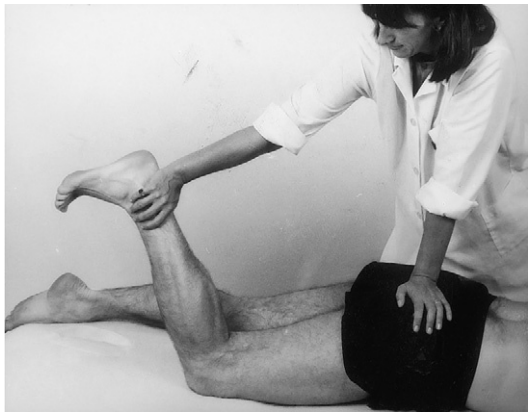


7. Draw test

8. Glide test

9. Meniscal tests

10. Resisted extension



11. Resisted flexion

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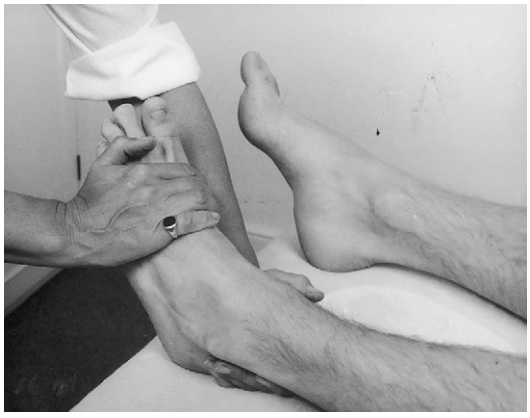
Ankle Examination

1. Ankle passive dorsiflexion

2. Ankle passive plantarflexion

3. Ankle passive eversion



4. Ankle passive inversion

5. Subtalar passive abduction

6. Subtalar passive adduction

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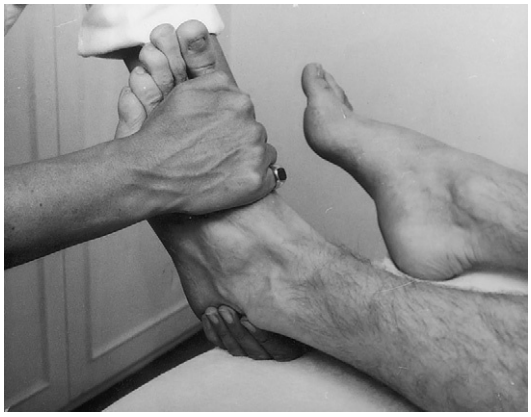
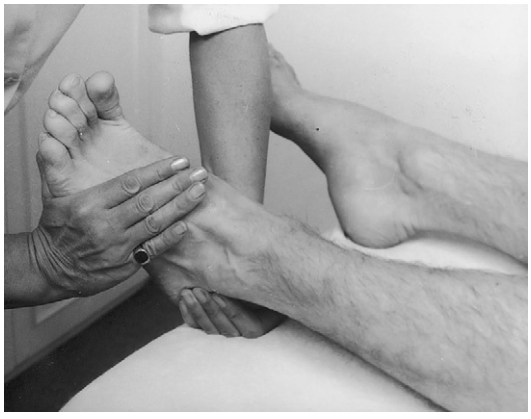
7. Subtalar eversion

8. Forefoot inversion



9. Resisted dorsiflexion

10. Resisted plantarflexion



11. Resisted eversion

12. Resisted inversion

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HIP JOINT

Acute or chronic capsulitis

Causes and findings

- Osteoarthritis, rheumatoid arthritis or traumatic capsulitis with night pain and severe radiating pain no longer responding to physiotherapy
- Buttock, groin and/or anterior thigh pain
- Painful limitation in capsular pattern – most loss of medial rotation, hard endfeel

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
5 ml	Spinal 22G 3.5″ (90 mm)	40 mg	4 ml 1%	5 ml

Anatomy

The hip joint capsule attaches to the base of the surgical neck of the femur so if the needle is touching the neck, the solution will be deposited within the capsule. The greater trochanter is a triangular bone with a sharp angulation of the apex overhanging the neck. This part is difficult to palpate, especially on large patients, so allow at least a thumb's width proximal to the most prominent part of the trochanter. The safest and easiest approach is from the lateral aspect.

Technique

- Patient lies on pain-free side with lower leg flexed and upper leg straight resting horizontally on pillow
- Palpate the triangular greater trochanter with caudal thumb and middle finger placed either side of the base and identify the apex of the bone with index finger
- While passively abducting leg, identify dip at superior point of apex with cephalic index
- Insert needle perpendicularly about a thumb's width proximal to palpable apex of trochanter until it touches the neck of femur
- Inject solution as a bolus

Comments

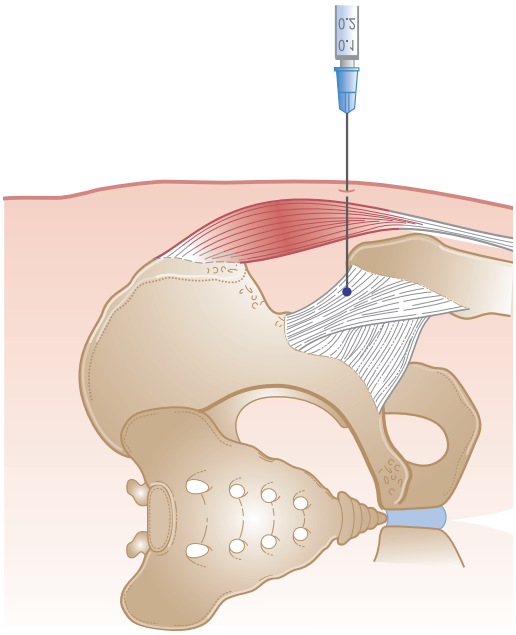
The lateral approach to the hip joint is both simple and safe. It is not necessary to do the technique under fluoroscopy and the procedure is not painful. There is usually no sensation of penetrating the capsule. This injection is usually given to patients who are on a waiting list for surgery, but the joint should not be injected within at least 6 weeks of surgery because reduced immunity could result in greater possible risk of infection. It is usually successful in giving temporary pain relief and can, if necessary, be repeated at intervals of no less than three 3 months. An annual X-ray monitors degenerative changes.

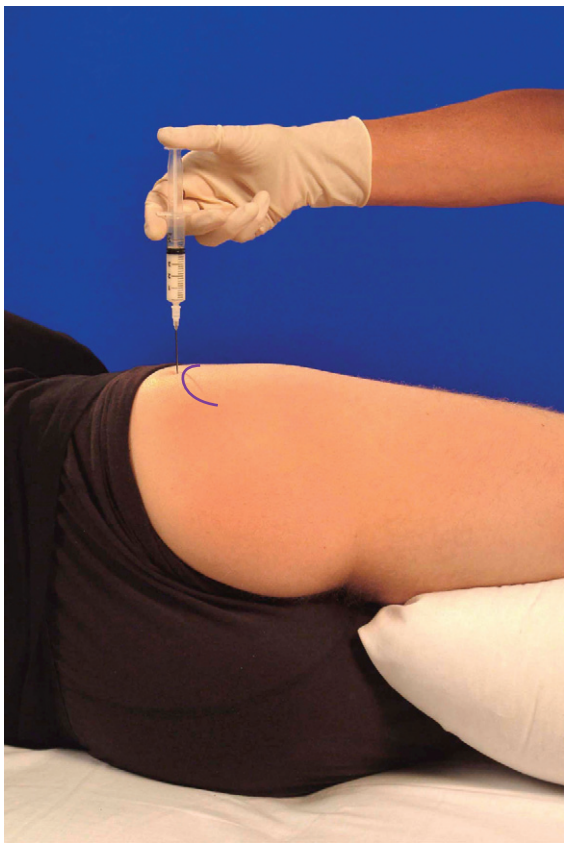
Alternative approaches

For large patients the total volume can be increased to 8–10 ml. 40 mg Adcortyl, giving 4 ml of volume, might be the preferred steroid here. For large individuals, a longer spinal needle might be required. During the early stages of the degenerative process, when the pain is local, there is minimal night pain and endfeels are still elastic with reasonably good function, physiotherapy can be effective.

Aftercare

Patient gradually increases pain-free activity maintaining range with a home stretching routine but limits weight-bearing exercise.





GLUTEAL BURSA

Chronic bursitis

Causes and findings

- Overuse
- Pain and tenderness over the upper lateral quadrant of the buttock
- Painful: passive flexion, abduction and adduction; resisted abduction and extension

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
5 ml	Spinal 22G 3.5″ (90 mm)	40 mg	4 ml 1%	5 ml

Anatomy

Gluteal bursae are variable in number, size and shape. They can lie deep to the gluteal muscles on the blade of the ilium and also between the layers of the three muscles. Palpation for the centre of the painful site guides the placement of the needle but comparison between the two sides is essential as this area is always tender.

Technique

- Patient lies on unaffected side with lower leg extended and upper leg flexed
- Identify and mark centre of tender area in upper outer quadrant of buttock
- Insert needle perpendicular to skin until it touches bone of ilium
- Inject solution in areas of no resistance while moving needle in a circular manner out towards surface – imagine the needle walking up a spiral staircase

Comments

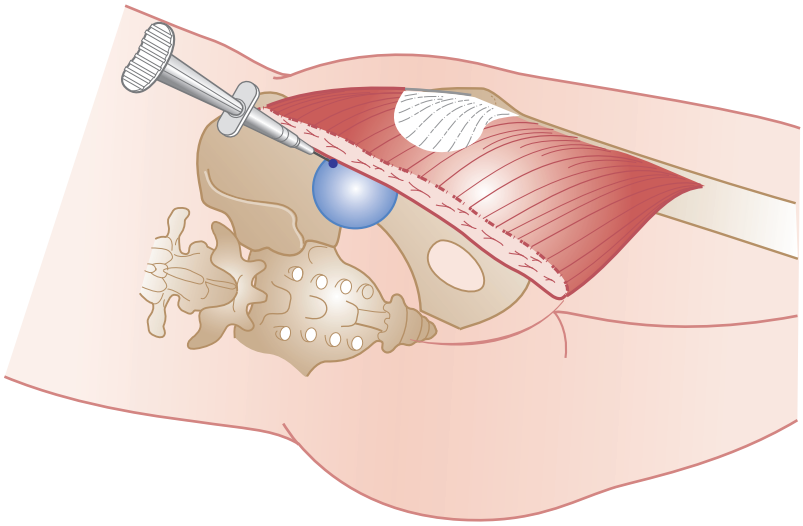
There are no major blood vessels or nerves in the area of the bursae so the injection is safe. Feeling for a loss of resistance beneath and within the glutei guides the clinician in depositing the fluid. Pain referring from the lumbar spine or sacroiliac joint can often be mistaken for gluteal bursitis. The mere presence of tenderness mid-buttock, normal in most individuals, should not be considered diagnostic of an inflamed bursa.

Alternative approaches

For large individuals, a longer spinal needle might be required.

Aftercare

The patient must avoid overusing the leg for a week and can then gradually resume normal activities. Addressing any muscle tightness or imbalance and retraining in the causative sporting activity is necessary.



PSOAS BURSA

Chronic bursitis

Causes and findings

- Overuse – especially activities involving repeated hip flexion, e.g. running, hurdling
- Pain in groin
- Painful: passive flexion, adduction, abduction, extension; resisted flexion and adduction. Scoop test – passive compression of femur from full flexion into adduction

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
5 ml	Spinal 22G 3.5″ (90 mm)	20 mg	2 ml 2%	2.5 ml

Anatomy

The psoas bursa lies between the iliopsoas tendon and the anterior aspect of the capsule over the neck of the femur. It is situated deep to three major structures in the groin – the femoral vein, artery and nerve, lying at the level of the inguinal ligament. For this reason, careful placement of the needle is essential. Following the instructions below ensures that the needle will pass obliquely beneath the neurovascular bundle.

Technique

- Patient lies supine
- Identify femoral pulse at mid-point of inguinal ligament. Mark a point three fingers distally and three fingers laterally, in line with the anterior superior iliac spine on medial edge of sartorius
- Insert needle at this point and aim 45° cephalad and 45° medially. Visualize the needle sliding under the three major vessels through the psoas tendon until point touches bone on anterior aspect of neck of femur
- Withdraw slightly and inject as bolus deep to tendon

Comments

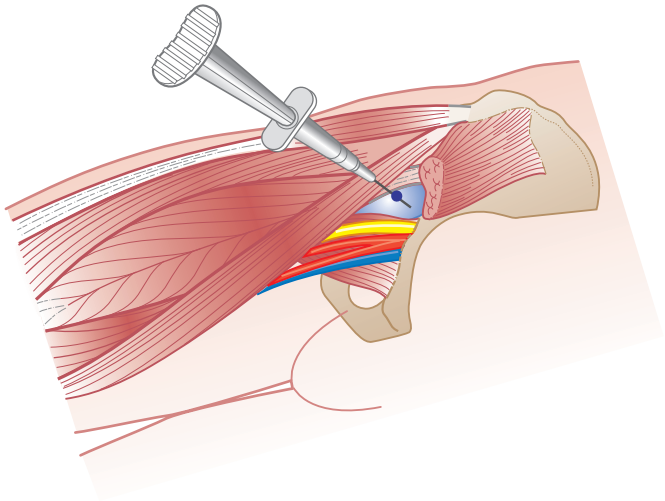
Although this injection might appear intimidating to the clinician at the first attempt, the approach outlined above is safe and effective. Very occasionally it is possible to catch a lateral branch of the femoral nerve and temporarily lose power in the quadriceps. If the patient complains of a tingling or burning pain during the process, reposition the needle before depositing solution. Differential diagnoses include local lesions such as hip joint pathology, adductor strain, hernia, abdominal muscle sprain, cutaneous nerve entrapment, pubic symphysitis, testicular disease, fracture and referred symptoms from lumbar spine, sacroiliac joint and genitourinary organs. Suspicion of any of these should be maintained until the clinician is satisfied of the cause of the symptoms. If in doubt, a diagnostic injection of local anaesthetic alone is advisable.

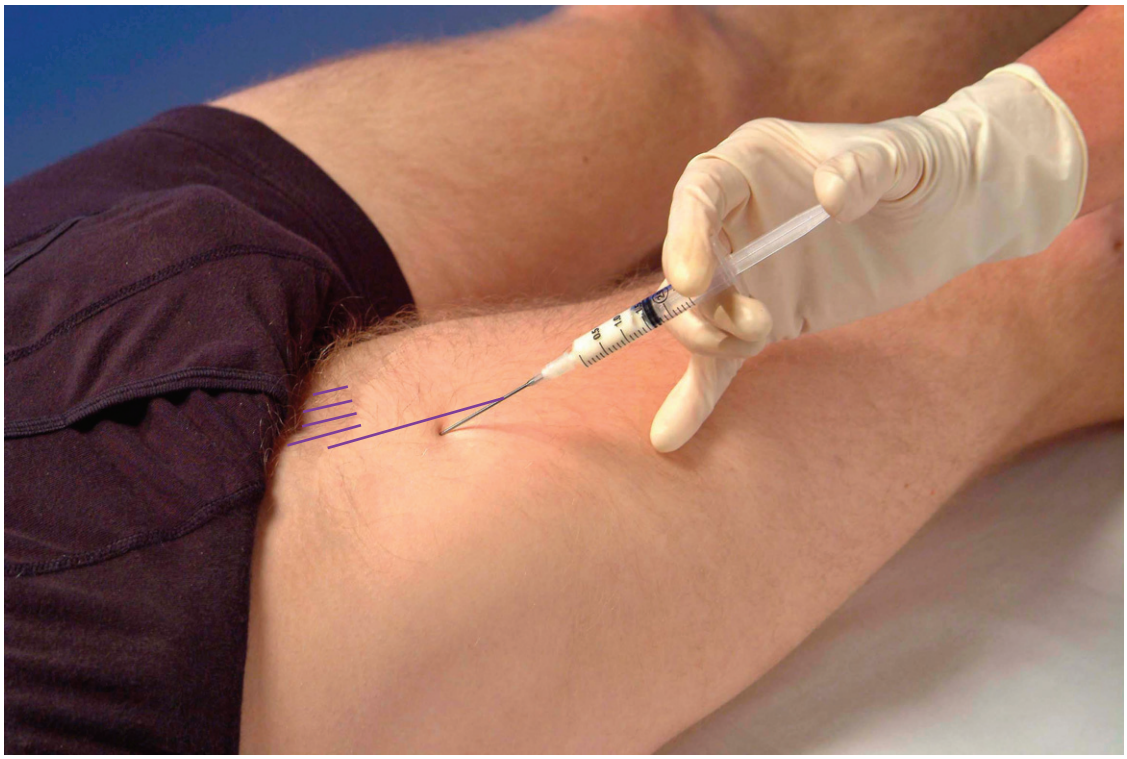
Alternative approaches

For large individuals, a longer spinal needle might be required.

Aftercare

Absolute avoidance of the activities that irritated the bursa must be maintained for at least a week, then stretching of hip extension and muscle-balancing programme is initiated.





TROCHANTERIC BURSA

Acute or chronic bursitis

Causes and findings

- Usually a direct blow or fall onto hip; occasionally overuse or, in the thin elderly patient, lying on the same side every night on a hard mattress
- Pain and tenderness over greater trochanter
- Painful: passive hip abduction, adduction, possibly flexion and extension; resisted abduction

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The trochanteric bursa lies over the greater trochanter of the femur. It is approximately the size of a golf ball and is usually tender to palpation.

Technique

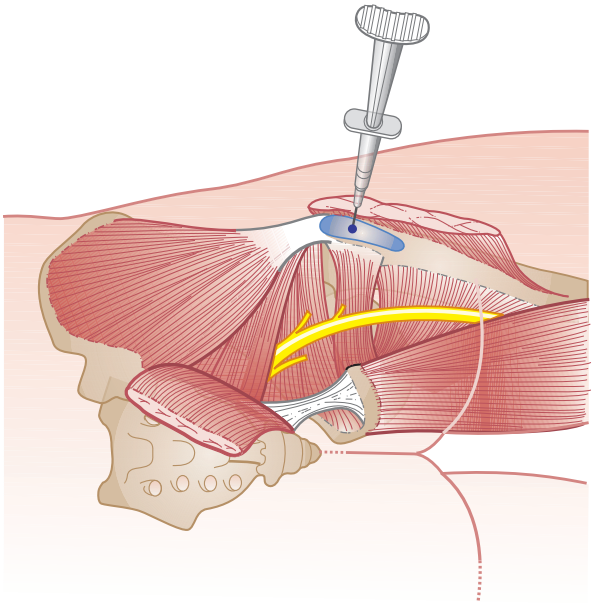
- Patient lies on unaffected side with lower leg flexed and upper leg extended
- Identify and mark centre of tender area over greater trochanter
- Insert needle perpendicularly at centre of tender area and advance to touch bone
- Inject by feeling for area of no resistance and introduce fluid there as a bolus

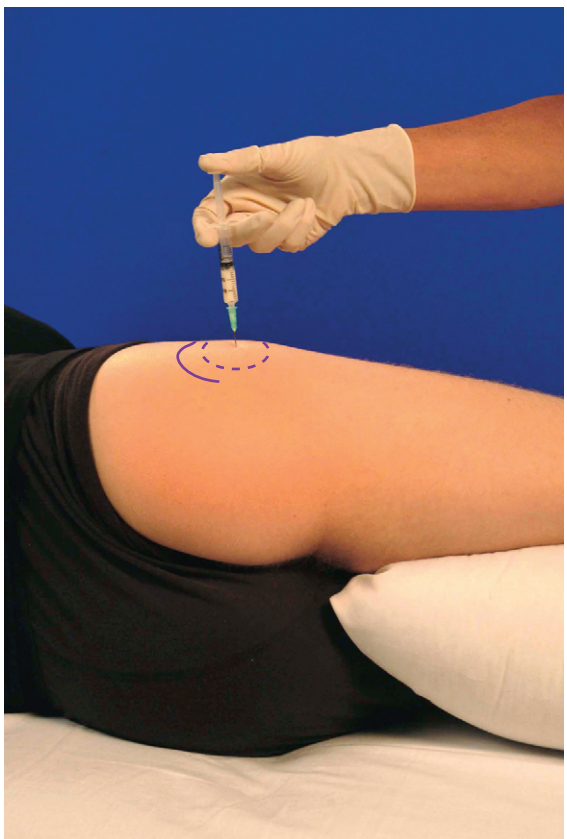
Comments

A fall or direct blow onto the trochanter will often cause a haemorrhagic bursitis. This calls for immediate aspiration of blood prior to the infiltration.

Aftercare

Patient should avoid overuse for 1 week and then gradually return to normal activity. If the cause is lying on a hard mattress, the trochanter can be padded with a large ring of sticky felt. A change of lying position is encouraged and the mattress might need to be changed. Stretching of the iliotibial band can also help.





ADDUCTOR TENDONS

Chronic tendinitis

Causes and findings

- Overuse or trauma
- Pain in groin at origin from pubis or mid-tendon
- Painful: resisted adduction; passive abduction

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The adductor tendons arise from the pubis and are approximately two fingers wide at their origin. The lesion can lie at the teno-osseous junction or in the body of the tendon. The technique described is for the more common site at the teno-osseous junction.

Technique

- The patient lies supine with leg slightly abducted and laterally rotated
- Identify and mark the origin of the tendon
- Insert needle into tendon, angle towards pubis and touch bone
- Pepper solution into teno-osseous junction

Comments

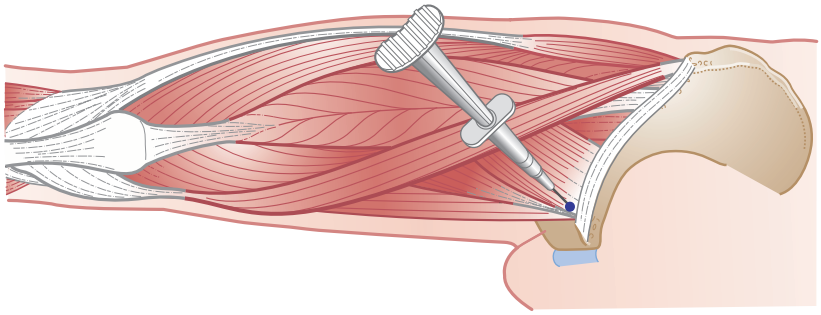
Sprain of these tendons is commonly thought to cause 'groin strain'. However, there are many alternative causes of pain in the groin (see psoas bursa technique) and these should be eliminated carefully.

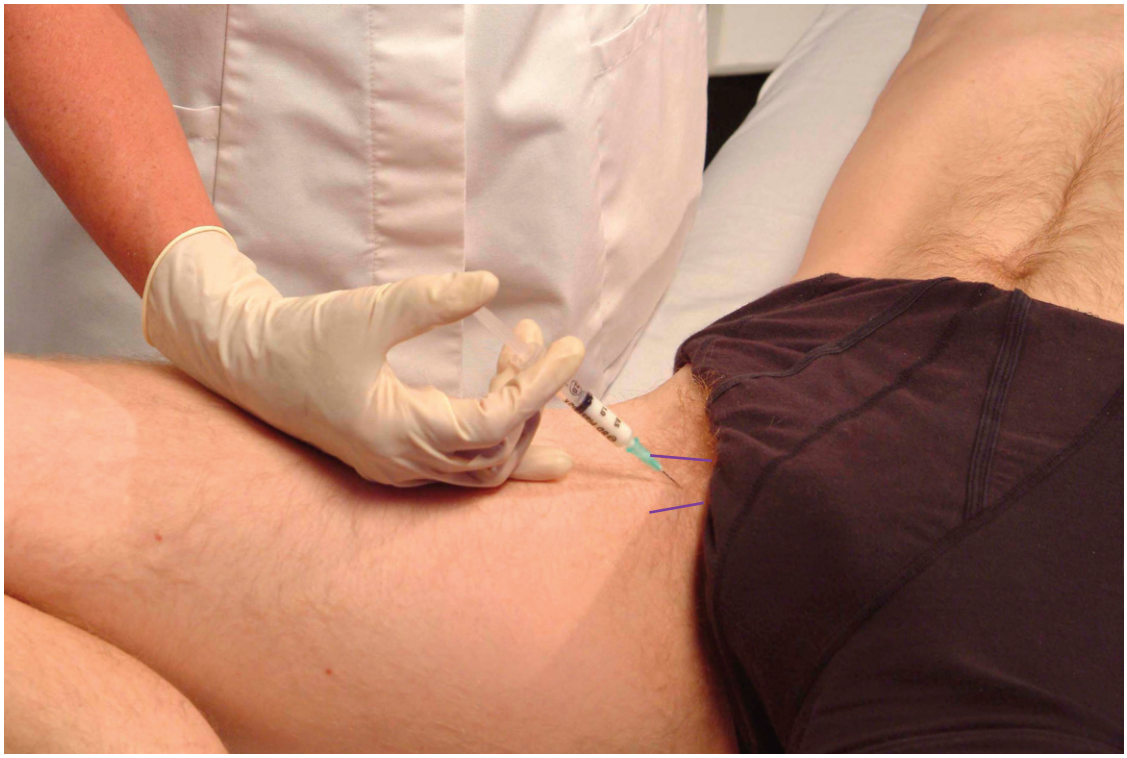
Alternative approaches

For the less common site at the body of the tendon, the solution is peppered into the tender area in the body, but deep friction massage and stretching may be more effective here.

Aftercare

Rest for at least a week then start a graduated stretching and strengthening programme. Deep friction massage may be used as well to mobilize the scar.





HAMSTRING TENDON AND ISCHIAL BURSA

Acute or chronic tendinopathy or ischial bursitis

Causes and findings

- Friction overuse, e.g. prolonged cycling; trauma e.g. fall onto buttock
- Pain in buttock over tuberosity
- Painful: resisted extension; passive straight leg raise

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Green 21G 2″ (50 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The hamstring tendons have a common origin arising from the ischial tuberosity and are approximately three fingers wide here. The ischial bursa lies between the gluteus maximus and the bone of the ischial tuberosity.

Technique

- Patient lies on unaffected side with lower leg straight and upper leg flexed
- Identify ischial tuberosity and mark tendon lying immediately distal
- Insert needle into mid-point of tendon and angle up toward tuberosity to touch bone
- Pepper solution into teno-osseous junction of tendon or inject as bolus

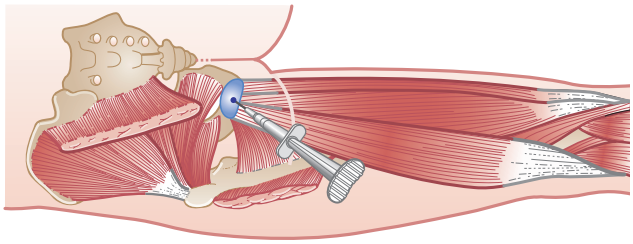
Comments

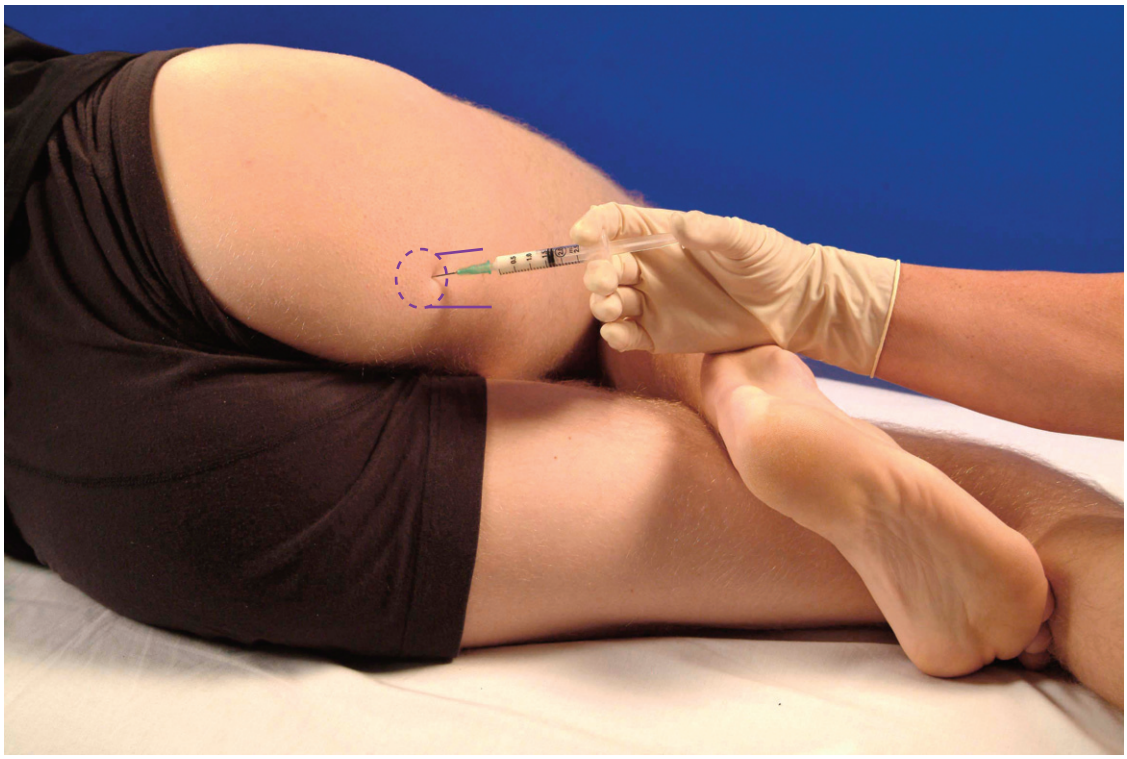
Tendinitis and bursitis can occur together at this site, in which case a larger volume is drawn up and both lesions infiltrated. As usual, it is difficult to differentiate between the two lesions, but if there is a history of a fall or friction overuse and extreme tenderness at the tuberosity, bursitis is suspected.

Occasionally, haemorrhagic bursitis can occur as a result of a hard fall. Aspiration of the blood is then performed prior to infiltration.

Aftercare

Avoidance of precipitating activities such as sitting on hard surfaces or prolonged running is maintained for at least a week and then a graduated stretching and strengthening programme is started.





LATERAL CUTANEOUS NERVE

Meralgia paraesthetica

Causes and findings

- Entrapment neuropathy from compression of nerve by obesity, pregnancy or prolonged static flexed positions
- Defined oval area of numbness over anterolateral thigh; occasionally painful paraesthesia
- Tender at inguinal ligament or where nerve emerges through fascia

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Green 21G 2″ (50 mm)	20 mg	Nil	0.5 ml

Anatomy

The lateral cutaneous nerve of the thigh arises from the outer border of the psoas and crosses over the iliacus. It passes under or through the inguinal ligament, through the femoral fascia and emerges superficially about 10 cm distal and in line with the anterior superior iliac spine.

Technique

- Patient lies supine
- Identify tender area at inguinal ligament or at distal point in thigh
- Inject as bolus around compressed nerve, avoiding nerve itself

Comments

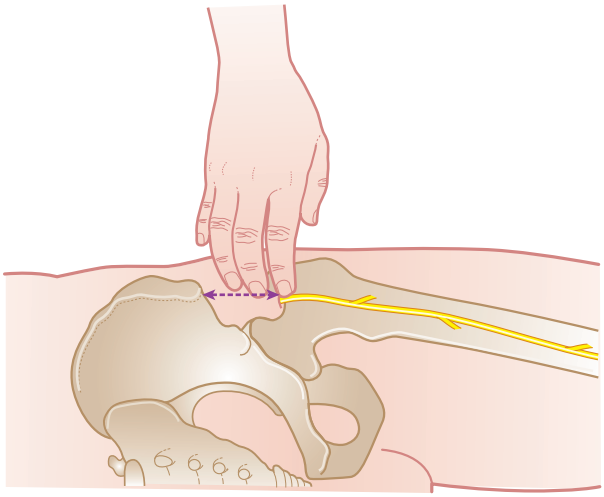
Differential diagnoses include referred symptoms from lumbar spine or sacroiliac joint lesions, or local lesions such as hip joint pathology, arterial claudication, herpes zoster. As with other nerve compression injections, the nerve itself must not be injected. If the patient reports increased tingling or burning pain, the needle point should be moved before the steroid is injected.

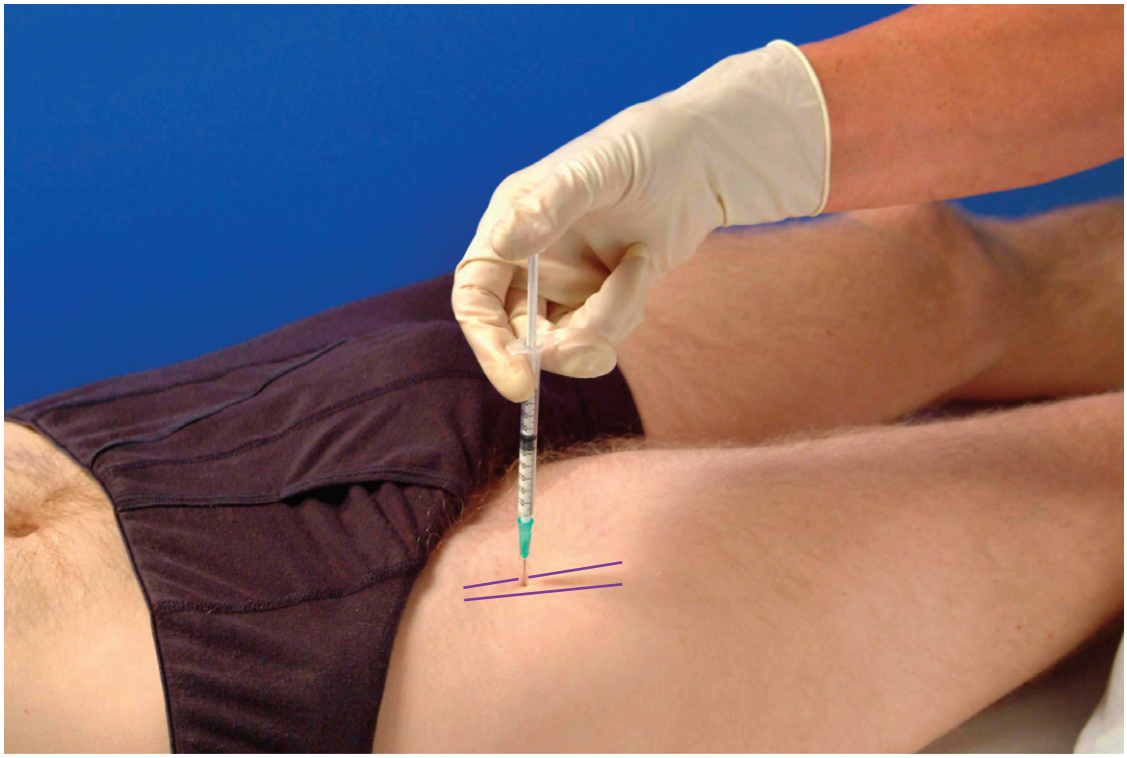
Alternative approach

This lesion often spontaneously resolves. Advice on avoidance of compression and reassurance as to the nature and normal outcome of the condition might be all that is required.

Aftercare

Removing the cause is of prime importance, i.e. losing weight, avoiding tight clothing, correcting sitting posture. If the patient is pregnant the compression might be from the growing fetus, and symptoms will normally abate after delivery.





KNEE JOINT

Acute or chronic capsulitis

Causes and findings

- Osteoarthritis, rheumatoid arthritis, gout or trauma
- Pain in knee joint, possible heat and effusion
- Painful and limited: more passive flexion than extension, hard endfeel

Equipment

Syringe	Needle	Adcortyl	Lidocaine	Total volume
10 ml	Green 21G 1.5″ (40 mm)	40 mg	6 ml 1%	10 ml

Anatomy

The knee joint has a potential capacity of approximately 120 ml or more in the average-sized adult. The capsule is lined with synovium, which is convoluted and so has a large surface area; in the large knee, therefore, more volume will be required to bathe the entire surface. Plicae, which are bands of synovium, might exist within the joint and can also become inflamed. The suprapatellar pouch is a continuum of the synovial capsule and there are many bursae around the joint.

Technique

- Patient sits with knee supported in extension
- Identify and mark medial edge of patella
- Insert needle and angle laterally and slightly upwards under patella
- Inject solution as bolus or aspirate if required

Comments

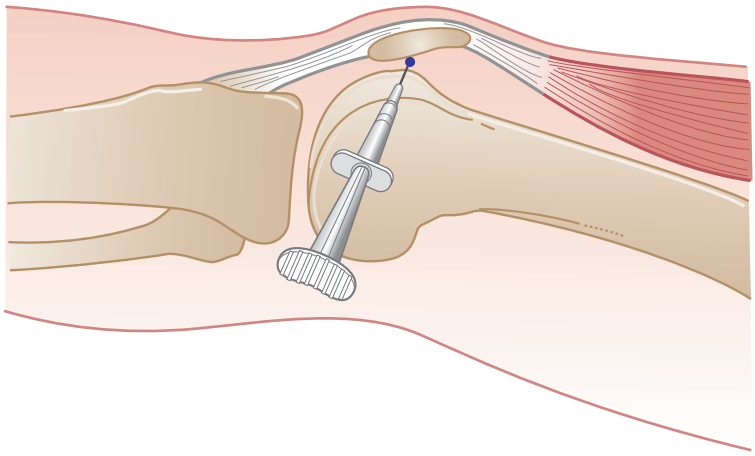
The injection will give temporary relief from pain and, provided the knee is not overused, this can last for some time. Repeat injections can be given at intervals of not less than three months with an annual X-ray to monitor joint degeneration. As with the hip joint, the patient might be awaiting surgery; the injection should not be given for at least 6 weeks prior to this.

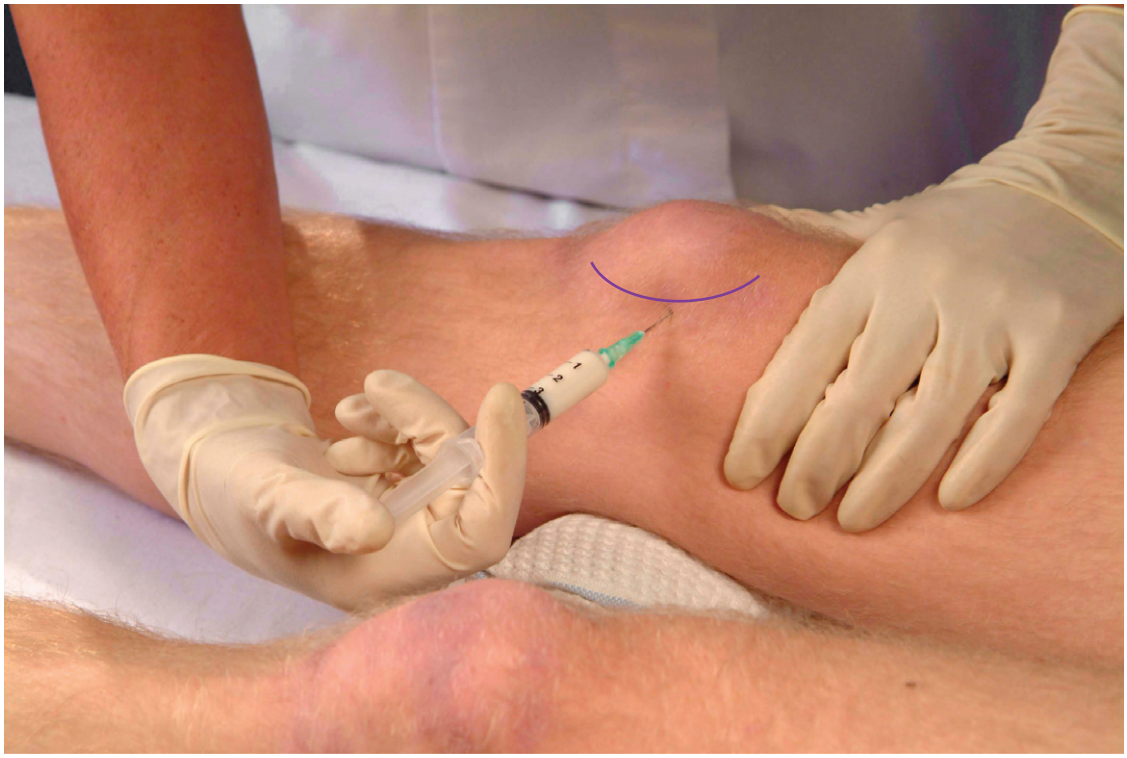
Alternative approaches

There are several ways to infiltrate or aspirate the knee joint – through the 'eyes of the knee', the supralateral approach into the suprapatella pouch just above the lateral pole of the patella, laterally at mid-point of patella or the medial approach as shown here[42]. One study showed that there was more successful intra-articular placement using the lateral patella approach than through the 'eyes of the knee', but did not compare the lateral with this medial approach. The advantage of this approach is that there is normally plenty of space to insert the needle between the medial condyle and the patella, where even small amounts of effusion can be aspirated. The same approach can be used whether infiltrating or aspirating serous fluid or blood. Using the larger volume of 40 mg of Adcortyl, giving 4 ml of volume, enables more of the joint surface to be bathed. Hyalgen or similar substances can also be injected here but are more expensive than corticosteroids and do not appear to have longer-lasting benefits (page 33).

Aftercare

The patient avoids undue weight-bearing activity for at least a week and is then given strengthening and mobilizing exercises to continue at home. One study indicated that total bed rest for 24 hours after injection in rheumatoid knees showed better results; however, the rest involved a hospital stay, which would not be cost effective.





SUPERIOR TIBIOFIBULAR JOINT

Acute or chronic capsulitis

Causes and findings

- Usually trauma e.g. fall with forced medial rotation and varus on flexed knee
- Pain over lateral side of knee
- Painful: resisted flexion of knee; full passive medial rotation of knee

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Orange 25G 0.5″ (16 mm)	20 mg	1 ml 2%	1.5 ml

Anatomy

The superior tibiofibular joint runs medially under the lateral slope of the tibia from superior to inferior. The anterior approach is safer as the peroneal nerve lies posterior to the joint.

Technique

- Patient sits with knee at right angle
- Identify head of fibula and mark joint line medial to it
- Insert needle at mid-point of joint line and aim obliquely laterally to penetrate capsule
- Deposit solution in bolus

Comments

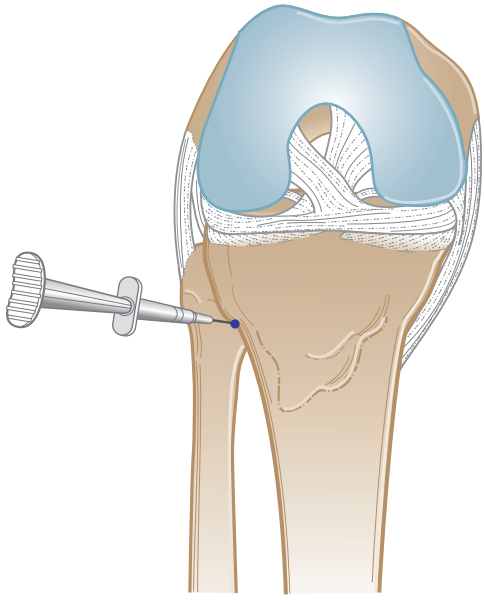
Occasionally the joint is subluxed and has to be manipulated before infiltration. The condition also occasionally occurs after severe ankle sprain.

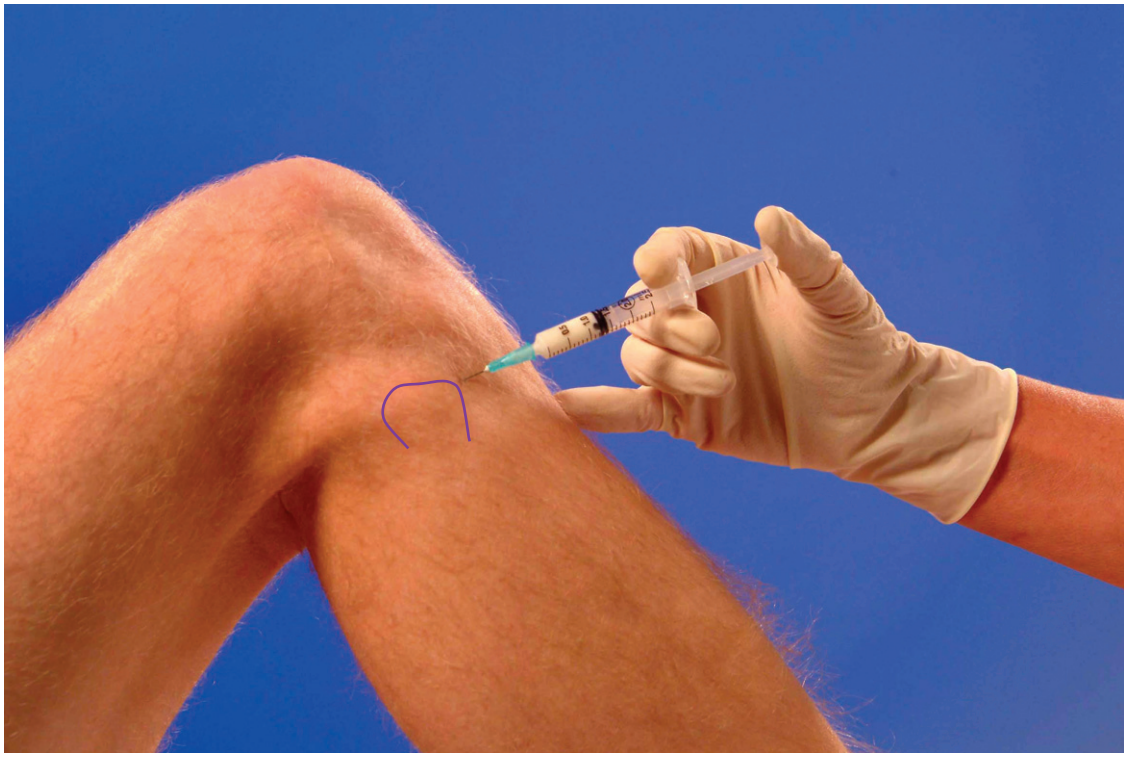
Alternative approach

The unstable joint can be treated with sclerotherapy and taping.

Aftercare

Advise relative rest for at least a week and then resumption of normal activities. Strengthening of the biceps femoris might be necessary.





BAKER'S CYST ASPIRATION

Causes and findings

- Spontaneous insidious onset, usually in osteoarthritic joint
- Obvious swelling in the popliteal fossa – often quite large
- Limited: active and passive knee flexion

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
10 ml	White 19G 1.5″ (40 mm)	nil	nil	

Anatomy

A Baker's cyst is a sac of synovial fluid caused by seepage through a defect in the posterior wall of the capsule of the knee joint, or by effusion within the semimembranosus bursa. The popliteal artery and vein and posterior tibial nerve pass centrally in the popliteal fossa and must be avoided.

Technique

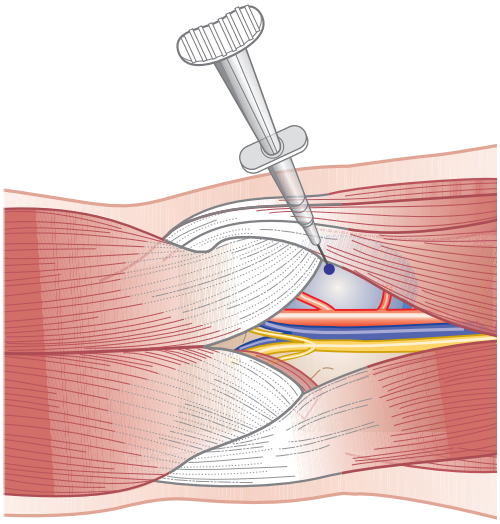
- Patient lies prone
- Mark spot two fingers medial to mid-line of fossa and two fingers below the popliteal crease
- Insert needle at marked spot and angle laterally at 45° angle
- Aspirate fluid found

Comments

If anything other than clear synovial fluid is removed, a specimen should be sent for culture and the appropriate treatment instigated. Invariably the swelling returns at some point but can be re-aspirated if the patient wishes.

Aftercare

A firm compression bandage can be applied for a day or two.



ILIOTIBIAL BAND BURSA

Chronic bursitis

Causes and findings

- Overuse – especially long-distance runners
- Pain on the outer side of the knee above the lateral femoral condyle
- Painful: resisted abduction of leg; passive adduction of leg

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1" (2 5 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The bursa lies deep to the iliotibial band just above the lateral condyle of the femur and is approximately the size of a golf ball.

Technique

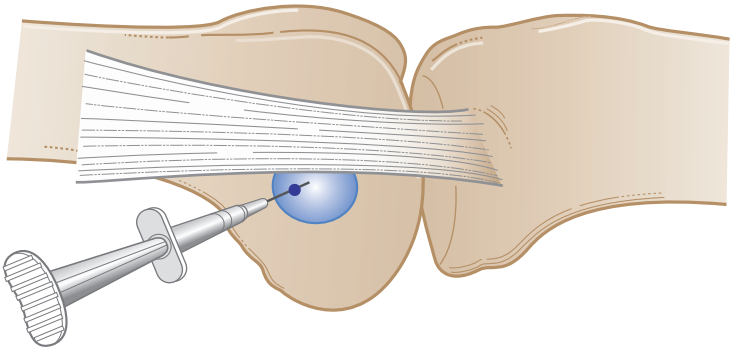
- Patient sits with knee supported
- Identify and mark tender area on lateral side of femur
- Insert needle into bursa passing through tendon to touch bone
- Deposit solution in bolus

Comments

The lower end of the iliotibial tract itself can be irritated, but invariably the bursa is also at fault. If both lesions are suspected, infiltration of both at the same time can be performed.

Aftercare

Absolute rest must be maintained for about 10 days and then a stretching and strengthening programme initiated. Footwear and running technique should be checked and corrected if necessary.



INFRAPATELLAR BURSA

Acute or chronic bursitis

Causes and findings

- Overuse – prolonged running or kneeling; trauma – direct blow
- Pain anterior knee below patella
- Painful: resisted extension of knee; full passive flexion of knee

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

There are two infrapatellar bursae – one lies superficial and one deep to the tendon. In a small study it was found that the deep bursa consistently lay posterior to the distal third of the tendon and was slightly wider; a fat pad apron extends from the retropatellar fat pad to partially compartmentalize the bursa. The technique described is for the deep bursa, which is more commonly affected.

Technique

- Patient sits with leg extended and knee supported
- Identify and mark tender area at mid-point of tendon
- Insert needle horizontally at lateral edge of the tendon just proximal to the tibial tubercle. Ensure that the needle does not enter the tendon
- Deposit solution as bolus

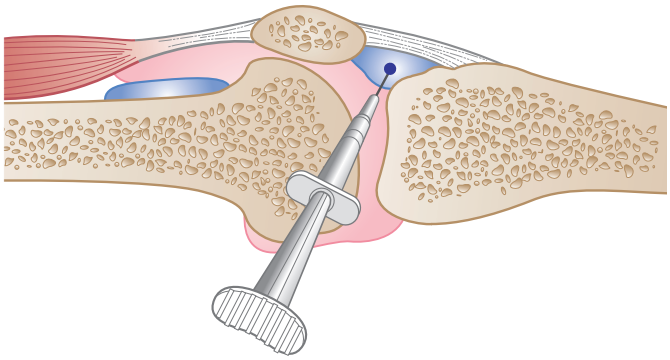
Comments

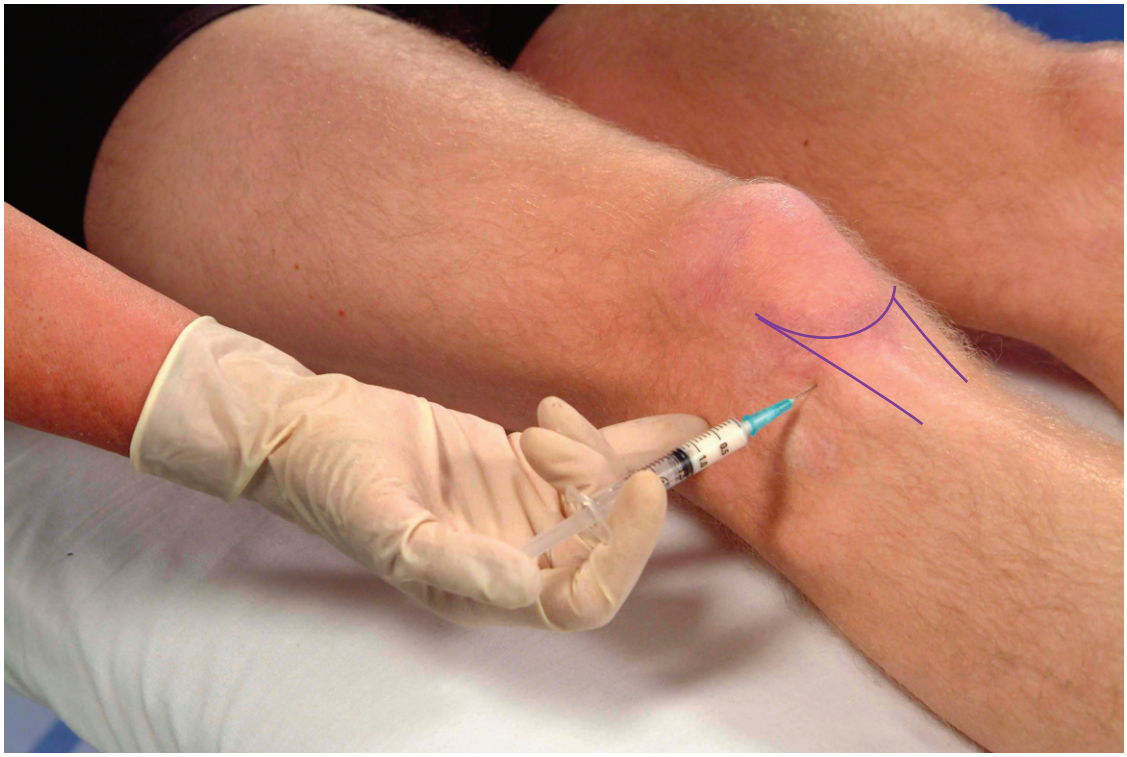
It would be tempting to believe that pain found at mid-point of the patella tendon is caused by tendinitis, but in the experience of the authors this is extremely rare at this site. Infrapatellar tendinitis is found consistently at the proximal teno-osseous junction on the patella, or rarely at insertion into the tibial tubercle. Pain here in an adolescent boy should be considered to be Osgood–Schlatter's disease and should not be injected.

For the superficial infrapatella bursa and the prepatellar bursa, palpate for the centre of the tender area and, using the same needle and dose, inject just deep to the skin and superior to the bone. Free flow of the fluid confirms the correct placement within the structure. Use hydrocortisone with thin, dark skinned individuals.

Aftercare

The patient must avoid all overuse of the knee for at least a week. When the cause is occupational, such as in carpet layers, a pad with a hole in it to relieve pressure on the bursa should be used. Graded stretching and strengthening exercises are then begun.





PES ANSEURINE BURSA

Chronic bursitis

Causes and findings

- Overuse – especially dancers or runners
- Pain just proximal to insertion of medial flexors of knee
- Painful: resisted flexion of knee

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The pes anseurine, or goose's foot, is the combined tendon of insertion of the sartorius, gracilis and semi-tendinosus. It attaches on the medial side of the tibia just below the knee joint line. The bursa lies immediately under the tendon just posterior to its insertion and is extremely tender to palpation in the normal knee.

Technique

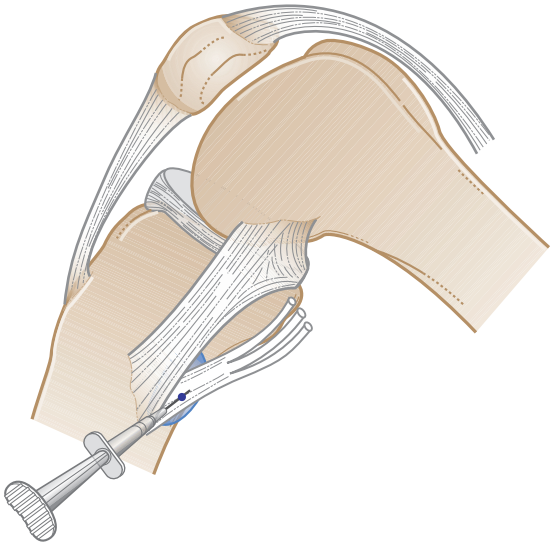
- Patient sits with knee supported
- Identify the pes anseurine tendon by flexing knee against resistance. Follow tendons distally to where they disappear at insertion into tibia. Mark tender area slightly proximal to insertion
- Insert needle into centre of tender area through tendon to touch bone
- Deposit solution in bolus

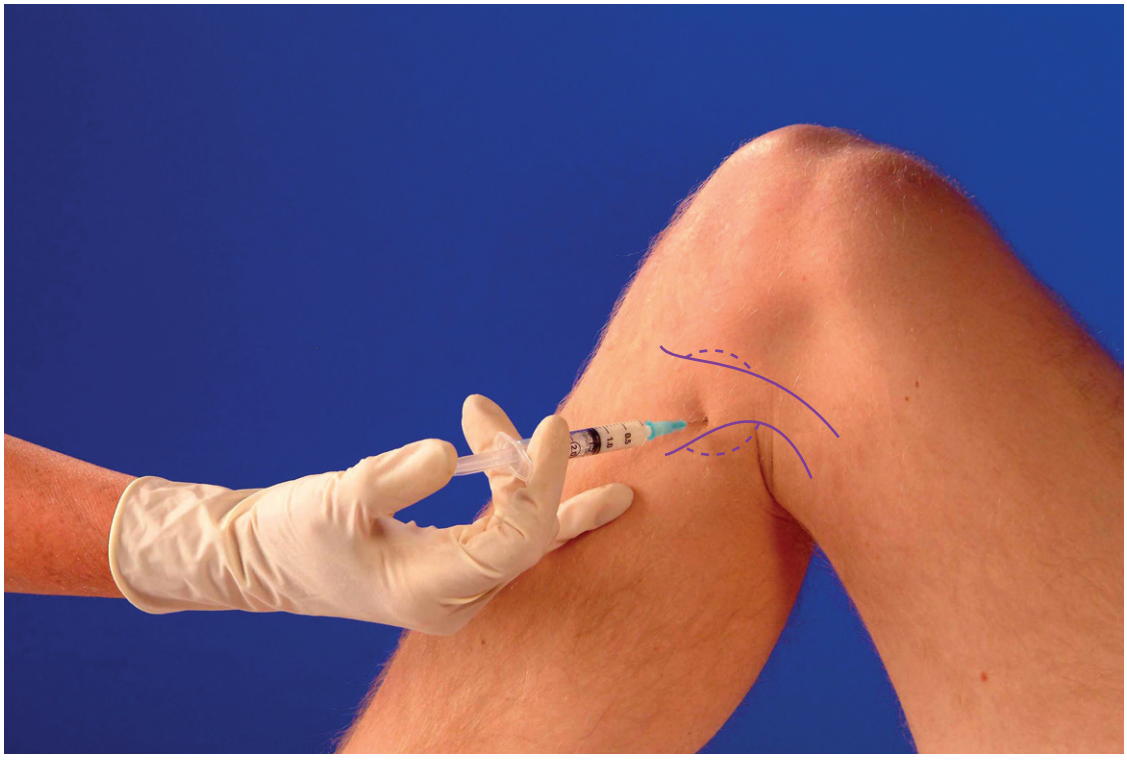
Comments

It is important to remember that the bursa is extremely tender to palpation on everybody so comparison testing must be done on both knees.

Aftercare

The patient should avoid overuse activities for at least a week, when graded stretching and strengthening exercises are started.





CORONARY LIGAMENTS

Ligamentous sprain

Causes and findings

- Trauma – a strong forced rotation of the knee with or without meniscal tear
- Pain usually at medial joint line
- Painful: passive lateral rotation; possibly meniscal grind tests

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The coronary ligaments are small thin fibrous bands attaching the menisci to the tibial plateaux. The medial coronary ligament is more usually affected. It can be found by flexing the knee to a right angle and turning the foot into lateral rotation. This brings the tibial plateau into prominence and the tender area is sought by pressing in and down onto the plateau.

Technique

- Patient sits with knee at right angle and planted foot laterally rotated
- Identify and mark tender area on tibial plateau
- Insert needle vertically down onto plateau
- Pepper all along tender area

Comments

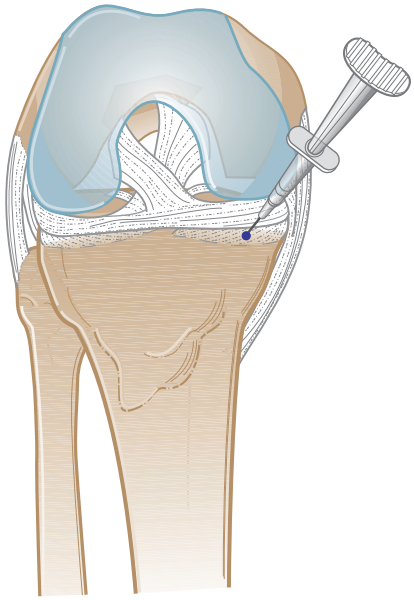
This lesion is commonly misdiagnosed; apparent meniscal tears, anterior cruciate sprain and patellofemoral joint lesions might be simple coronary ligament sprains.

Alternative approaches

These ligaments usually respond extremely well to deep friction massage – it is not uncommon to cure the symptoms in one session. The injection should be kept for where the friction treatment is not available or where the pain is too intense to allow the pressure of the finger. Tear or subluxation of the meniscus should be treated first by manipulation to attempt to reduce the tear.

Aftercare

Early mobilizing exercise to full range of motion without pain is started immediately.



MEDIAL COLLATERAL LIGAMENT

Chronic, or rarely, acute sprain

Causes and findings

- Trauma – typically flexion, valgus and lateral rotation of the knee e.g. skiing fall
- Pain along medial knee joint line
- Painful: passive valgus; passive lateral rotation of the knee

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1 ml 2%	1.5 ml

Anatomy

The medial collateral ligament of the knee passes distally from the medial condyle of the femur to the medial aspect of the shaft of the tibia and is approximately a hand's width long and three fingers wide at the joint line. It is difficult to palpate the ligament as it is so thin and is part of the joint capsule. It is usually sprained at the joint line.

Technique

- Patient lies with knee supported and slightly flexed
- Identify and mark medial joint line and tender area of ligament
- Insert needle at mid-point of tender area. Do not penetrate right through joint capsule
- Pepper solution along width of ligament in two rows

Comments

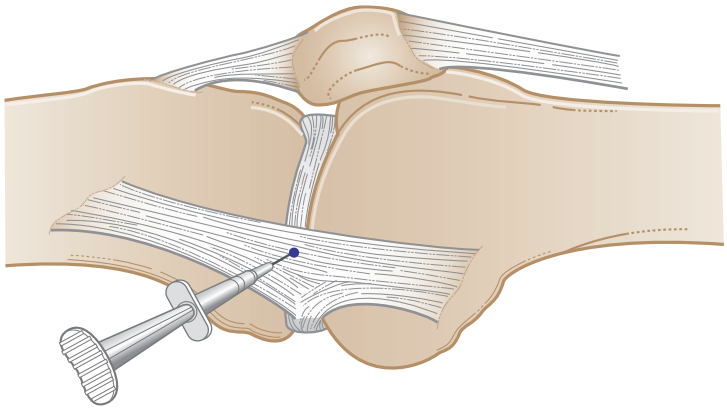
Occasionally the distal or proximal end of the ligament is affected, so the solution should be deposited there.

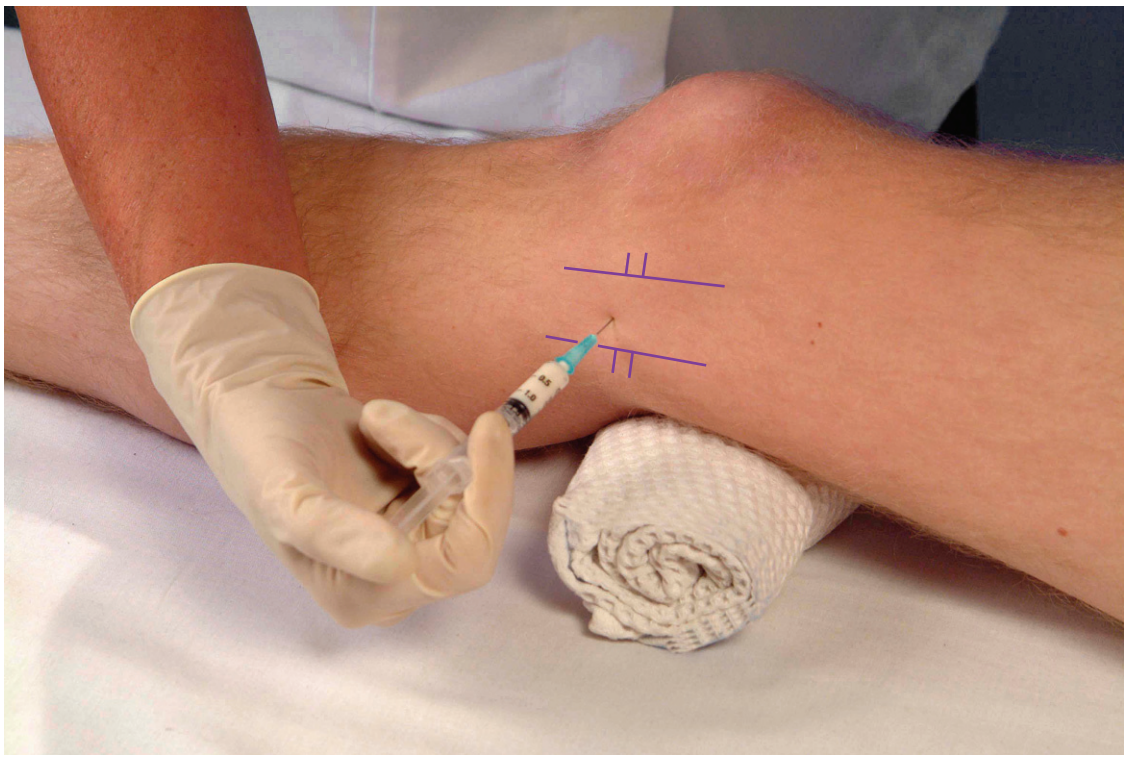
Alternative approaches

Sprain of this ligament rarely needs to be injected, as early physiotherapeutic treatment with ice, massage and mobilization is very effective. The injection approach can be used when this treatment is not available or the patient is in a great deal of pain.

Aftercare

For the acute ligament, gentle passive and active movement within the pain-free range is started immediately. For the chronic sprain, one session of deep friction massage and mobilization may be all that is required to obtain full movement.





INFRAPATELLAR TENDON

Chronic tendinitis

Causes and findings

- Overuse – jumpers and runners
- Pain at inferior pole of patella
- Painful: resisted extension of knee

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The infrapatellar tendon arises from the inferior pole of the patella and it is here that it is usually inflamed. The tendon is at least two fingers wide at its origin. It is an absolute contraindication to inject corticosteroid into the body of the tendon as it is a large, weight-bearing and relatively avascular structure. Tenderness at mid-point of the tendon is usually caused by infrapatellar bursitis.

Technique

- Patient sits with knee supported and extended
- Place web of cephalic hand on superior pole of patella and tilt inferior pole up. Mark tender area at origin of tendon on distal end of patella
- Insert needle at mid-point of tendon origin at an angle of 45°
- Pepper solution along tendon in two rows. There should always be some resistance to the needle to ensure that the needle is not intra-articular

Comments

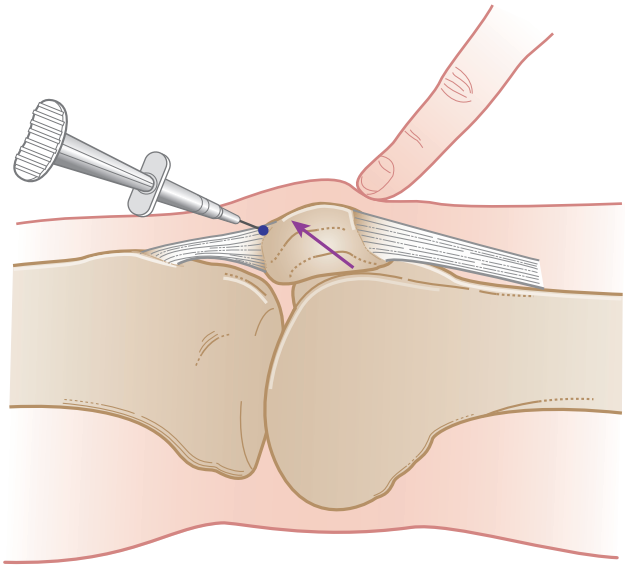
Injecting the origin of the infrapatellar tendon at the inferior pole is very safe, provided adequate rest is maintained afterwards and that no more than two injections are given in one attack. In an ageing patient with a chronic tendinopathy, scanning is recommended first to ensure that there are no degenerative changes in the substance of the tendon.

Alternative approach

In the case of the committed athlete or if scanning shows changes as above, deep friction, electrotherapy and taping should be given as potential danger of rupture is more real.

Aftercare

Absolute rest is recommended for at least 10 days before a stretching and strengthening programme is initiated.



QUADRICEPS EXPANSION

Muscle sprain

Causes and findings

- Overuse
- Pain usually on superior medial side of patella on going downhill or stairs
- Painful: resisted extension of the knee

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Orange 25G 0.5″ (16 mm)	10 mg	1.75 ml 2%	2 ml

Anatomy

The quadriceps muscle inserts as an expansion around the edges of the patella. The usual site of the lesion is at the superior medial pole. This is found by pushing the patella medially with the thumb and palpating up and under the medial edge with a finger to find the tender area.

Technique

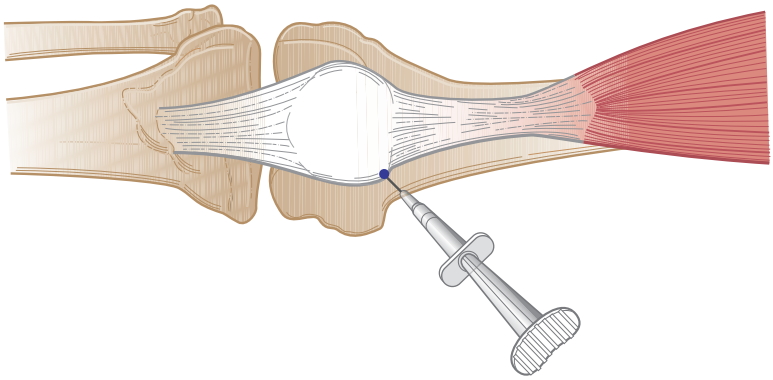
- Patient half lies on table with knee relaxed
- Identify and mark tender area usually on medial edge of superior pole of patella
- Insert needle and angle horizontally to touch bone of patella
- Pepper solution along line of insertion

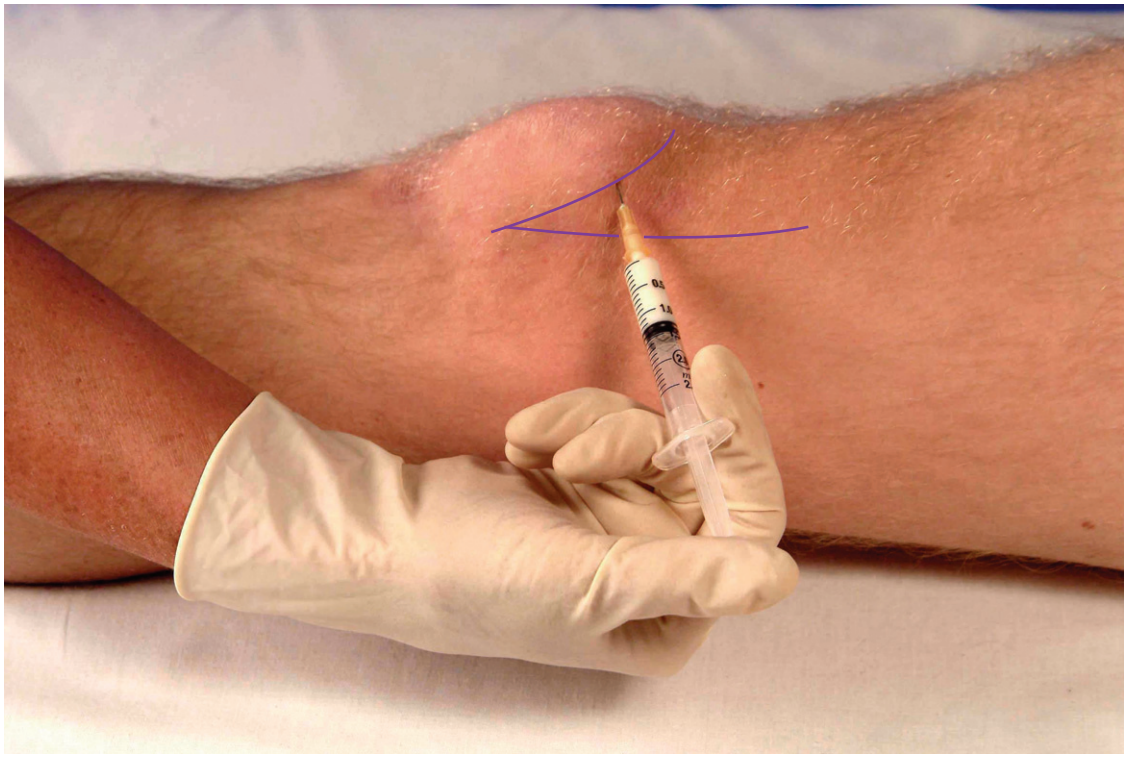
Comments

This lesion usually responds very well to two or three sessions of strong deep friction. The injection is used therefore when the friction is not available, the area is too tender, or to disinflame the expansion prior to friction a week later, in a combination approach. The same dose and technique may be used to inject inflamed plicae around the patella rim.

Aftercare

Patient avoids overusing the knee for at least a week and, when pain free, begins a progressive strengthening and stretching programme.





ANKLE JOINT

Chronic capsulitis

Causes and findings

- Post-trauma
- Pain at front of, or within, ankle
- Painful and limited: more passive plantarflexion than dorsiflexion with hard endfeel

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2.5 ml	Blue 23G 1.25″ (30 mm)	30 mg	1.75 ml 2%	2.5 ml

Anatomy

The easiest and safest entry point to the ankle joint is at the junction of the tibia and fibula just above the talus. A small triangular space can be palpated here.

Technique

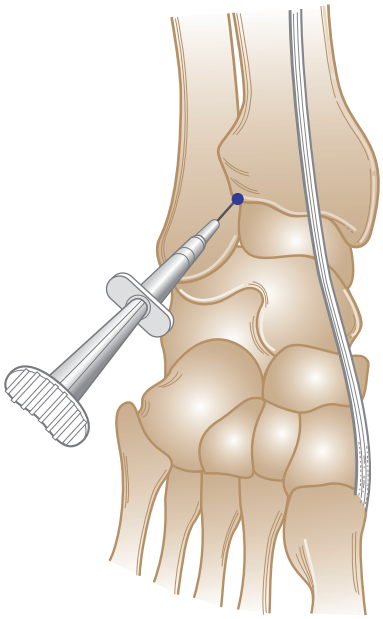
- Patient lies with knee bent to 90° and foot slightly plantarflexed
- Identify and mark small triangular space by passively flexing and extending the ankle while palpating
- Insert needle into joint angling slightly medially and proximally into joint space
- Deposit solution as bolus

Comments

The ankle joint rarely causes problems except after severe trauma or fracture, and then often many years later. The infiltration is usually successful in giving long-lasting pain relief and can be repeated if necessary at intervals of at least three months with an annual X-ray to monitor degenerative changes.

Aftercare

Excessive weight-bearing activities are avoided for at least a week. The patient should be warned that heavy overuse will cause a recurrence of symptoms and therefore long-distance running should be avoided. Weight control is also advised and footwear should be checked to ensure correct support.



SUBTALAR JOINT

Chronic capsulitis

Causes and findings

- Trauma – usually after fracture or severe impaction injury, often years later. Overuse in older obese patient
- Pain deep in medial and lateral sides of heel
- Painful and limited: passive adduction of the calcaneus

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	30 mg	1.25 ml 2%	2 ml

Anatomy

The subtalar joint is divided by an oblique septum into anterior and posterior portions. It is slightly easier to enter the joint just above the sustentaculum tali, which projects a thumb's width directly below the medial malleolus. It is necessary to deposit half the solution in the posterior cavity and the rest in the anterior.

Technique

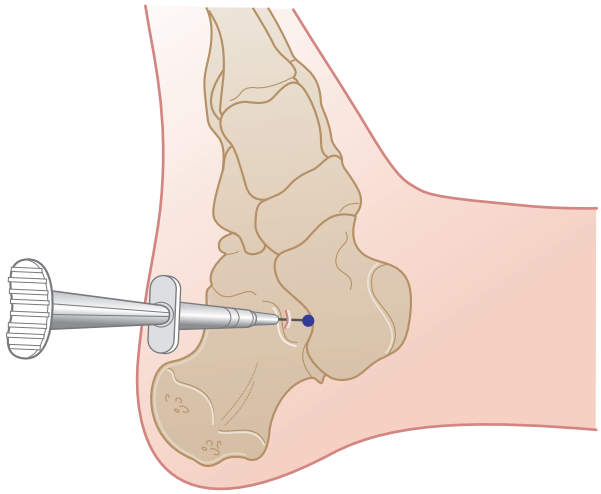
- Patient lies on side with foot supported so that medial aspect of heel faces upwards
- Identify bump of sustentaculum tali
- Insert needle perpendicularly immediately above and slightly posterior to sustentaculum tali
- Deposit half solution here
- Withdraw needle slightly, angle obliquely anteriorly through septum into anterior compartment of joint space and deposit remaining solution here

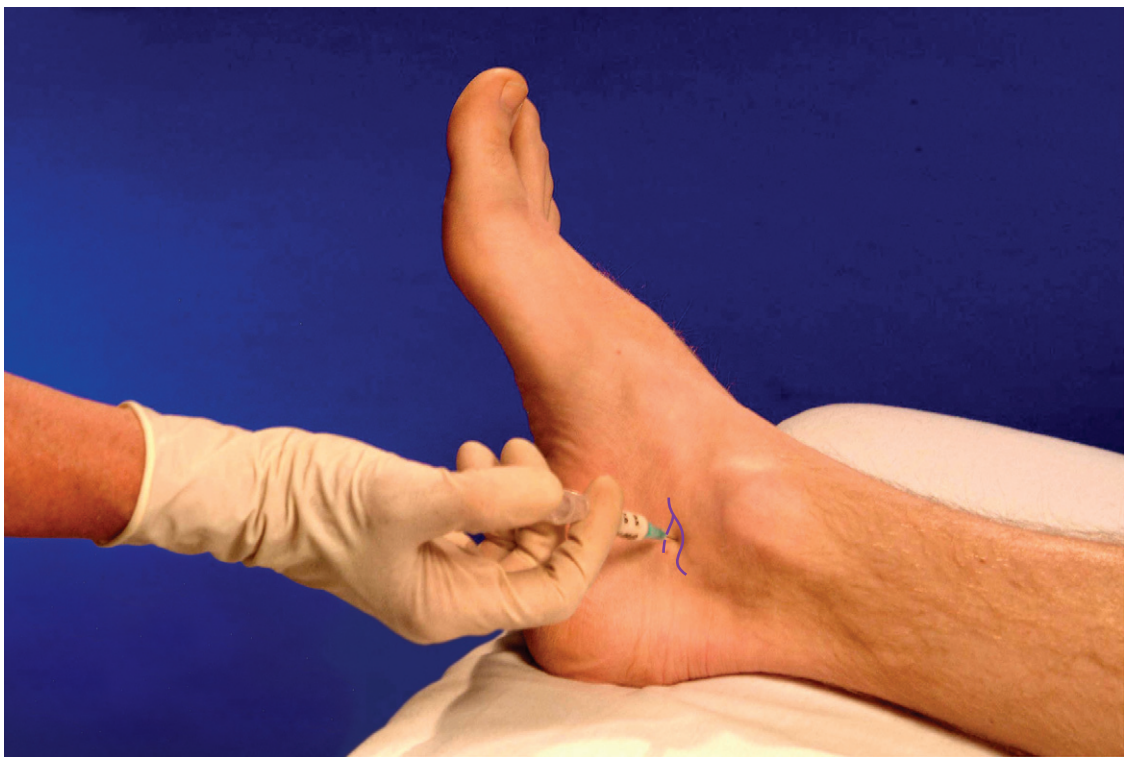
Comments

This is a difficult injection to perform due to the anatomical shape of the joint. It can be repeated at infrequent intervals if necessary.

Aftercare

The patient should avoid excessive weight-bearing activities for at least a week. Orthotics and weight control are helpful in preventing recurrence.





MIDTARSAL JOINTS

Acute or chronic capsulitis

Causes and findings

- Overuse or trauma – dancers who over-point or footballers
- Pain on dorsum of foot – usually at third metatarsocuneiform joint line
- Painful and limited: adduction and inversion of midtarsal joints

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1″ (25 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

There are several joints in the mid-tarsus, each with its own capsule. Gross passive testing in all six directions followed by local joint gliding and palpation should identify the joint involved.

Technique

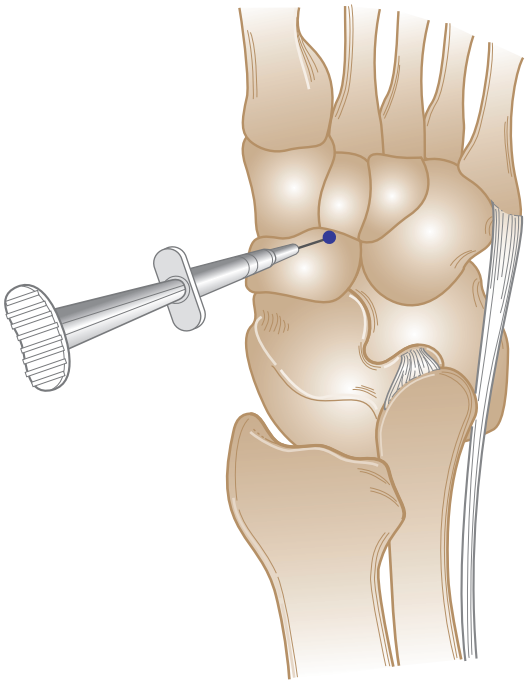
- Patient lies with foot supported in neutral
- Identify and mark tender joint line
- Insert needle down into joint space
- Pepper some solution into capsule and remainder as bolus into joint cavity

Comments

This is a successful treatment provided sensible attention is paid to aftercare.

Aftercare

Avoidance of excessive weight-bearing activities for at least a week is advised. Mobilizing and strengthening exercises and retraining of causal activities follow. Orthotics and weight control, if necessary, are useful additions.



TOE JOINTS

Acute or chronic capsulitis

Causes and findings

- Overuse or trauma. Hallux valgus may be present
- Pain locally in toe joint/s
- Painful and limited: extension of the big toe, flexion of other toes

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1–2 ml	Orange 25G 0.5″ (16 mm)	10–20 mg	0.5–1 ml 2%	0.75–1.5 ml

Anatomy

The first metatarsophalangeal joint line is found by palpating the space produced at the base of the metatarsal on the dorsal aspect, while passively flexing and extending the toe. Palpation of the collateral ligaments at the joint line on the sides of the other toes will identify the affected joint.

Technique

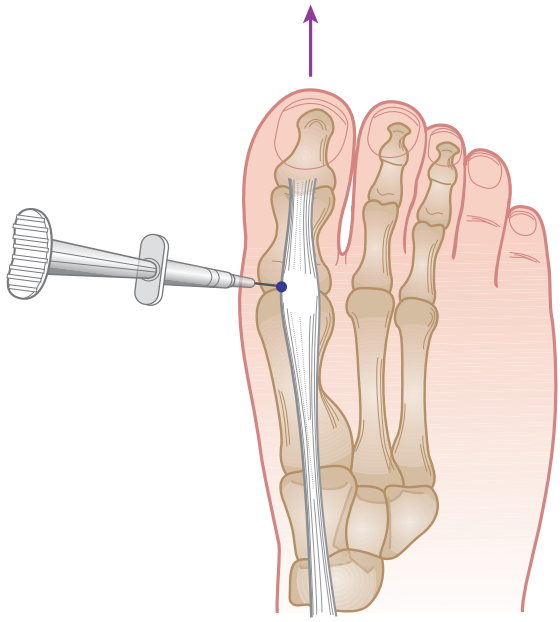
- Patient lies with foot supported
- Identify and mark joint line and distract affected toe with one hand
- Insert needle perpendicularly into joint space avoiding extensor tendons
- Deposit solution as bolus

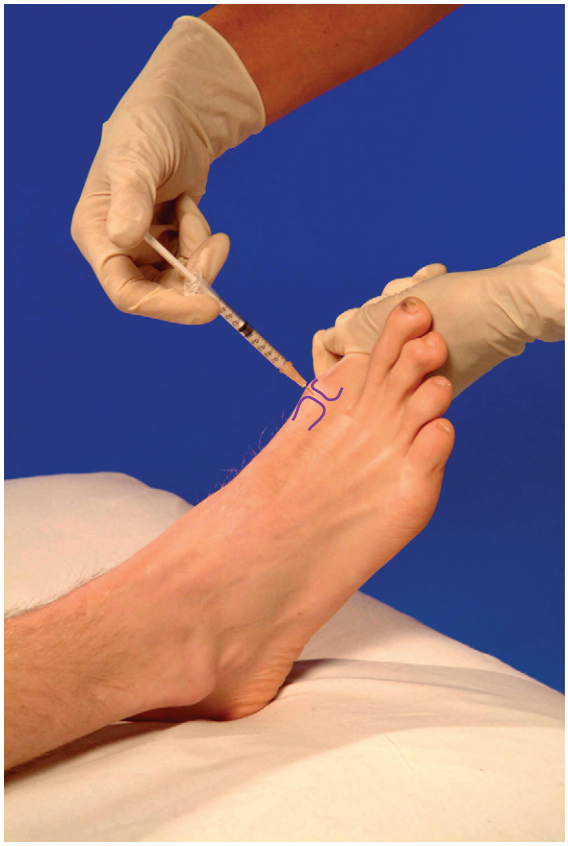
Comments

As with the thumb joint injection, this treatment can be very long-lasting. The other toe joints are injected from the medial or lateral aspect while under traction using smaller dose and volume e.g. 20 mg Kenalog plus 0.5 ml Lidocaine 1 ml total volume.

Aftercare

Avoidance of excessive weight-bearing activities for at least a week, together with taping of the joint and a toe pad between the toes. Care in choice of footwear and orthotics might be necessary.





ACHILLES BURSA

Chronic bursitis

Causes and findings

- Overuse – runners and dancers
- Pain posterior to tibia and anterior to body of Achilles tendon
- Painful: resisted plantarflexion, especially at end range; full passive plantarflexion

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1. 5%	2 ml

Anatomy

The Achilles bursa lies in the triangular space anterior to the tendon and posterior to the base of the tibia and the upper part of the calcaneus. It is important to differentiate between tendinitis and bursitis here because both are caused by overuse. In bursitis there is usually more pain on full passive plantarflexion when the heel is pressed up against the back of the tibia, thereby squeezing the bursa. Also, palpation of the bursa is very sensitive and the pain is usually felt more at the end of rising on tip-toe rather than during the movement. The safest approach is from the lateral side to avoid the posterior tibial artery and nerve.

Technique

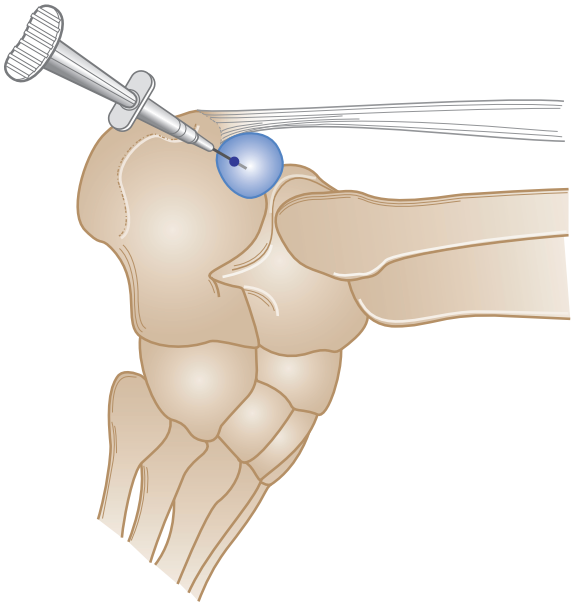
- Patient lies prone with foot held in some dorsiflexion
- Identify and mark tender area on lateral side of bursa
- Insert needle into bursa avoiding piercing the tendon
- Deposit solution as bolus

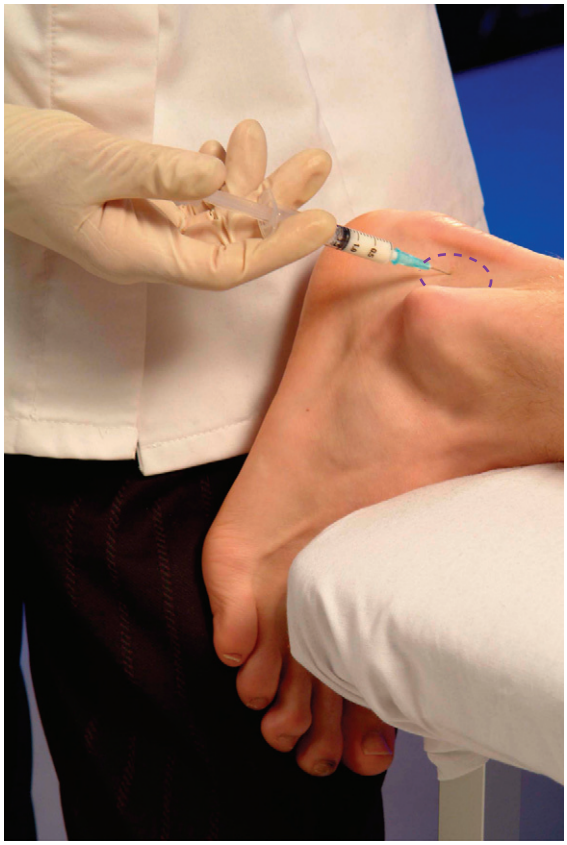
Comments

It is important to avoid penetrating the Achilles tendon and depositing the solution there. Any resistance to the needle requires immediate withdrawal and repositioning well anterior to the tendon.

Aftercare

Avoid overuse activities for at least 10 days, then start a stretching and eccentric exercise programme. Female ballet dancers need to avoid over-plantarflexing the ankle when on point.





DELTOID LIGAMENT

Chronic, or occasionally acute, sprain

Causes and findings

- Trauma, obesity or overuse. Overpronation of the foot
- Pain over medial side of heel below medial malleolus
- Painful: passive eversion of ankle in plantarflexion

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The deltoid ligament is a strong cuboid structure with two layers. It runs from the medial malleolus to the sustentaculum tali on the calcaneum and to the tubercle on the navicular. Sprains here are not as common as at the lateral ligament, but because they do not seem to respond well to deep friction and mobilization, injection is worth trying. The inflamed part is usually at the origin on the malleolus.

Technique

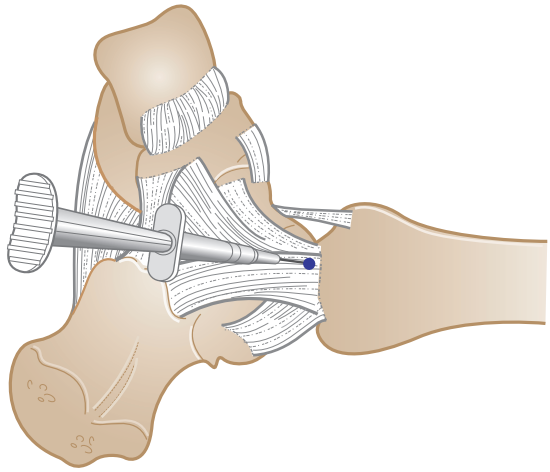
- Patient sits with medial side of foot accessible
- Identify lower border of medial malleolus and mark mid-point of ligament
- Insert needle and angle upwards to touch bone at mid-point of ligament
- Pepper solution along attachment to bone

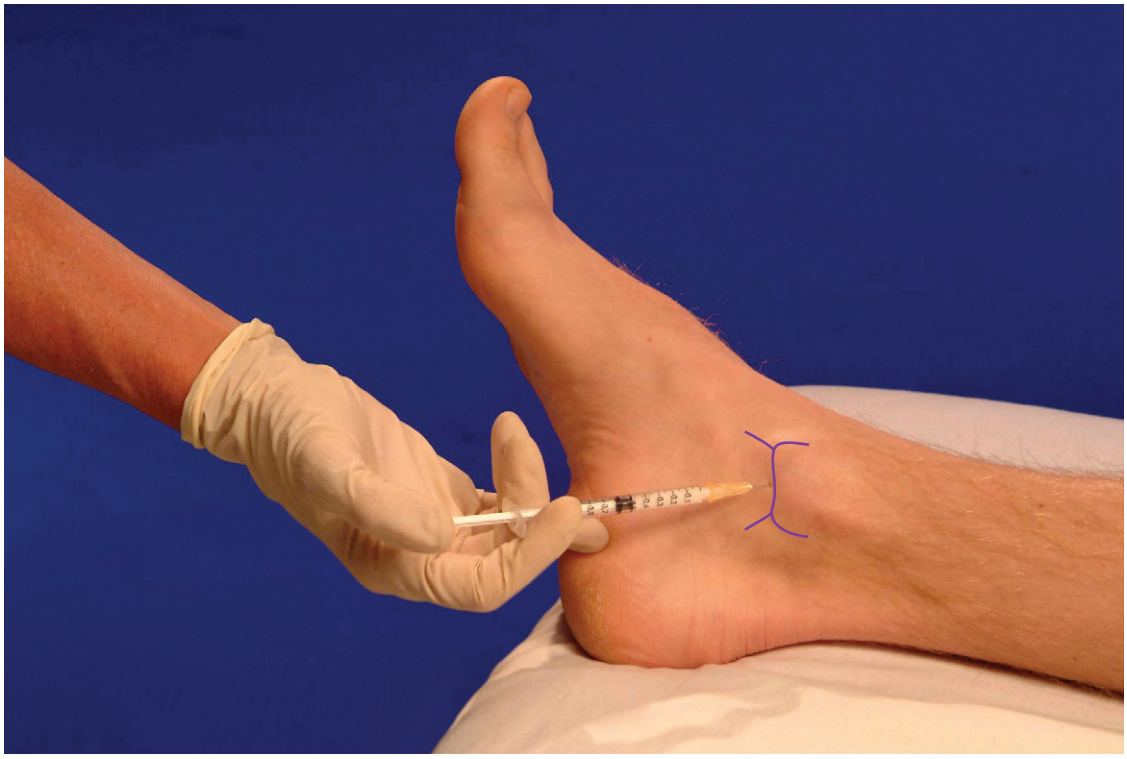
Comments

This is an uncommon but usually successful injection. Often physiotherapeutic treatment with deep massage, mobilization, muscle and balance rehabilitation works well, especially with podiatric advice and weight control.

Aftercare

Activity should be limited for at least a week. To prevent recurrence, the biomechanics of the foot must be carefully checked. Orthotics are almost always necessary and, in the overweight patient, advice on diet must be given.





LATERAL LIGAMENT

Acute, or occasionally chronic, sprain

Causes and findings

- Inversion injury
- Pain at lateral side of ankle
- Painful: passive inversion of ankle

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The anterior talofibular ligament runs distally and medially from the anterior inferior edge of the lateral malleolus to attach to the talus. It is a thin structure, approximately the width of the little finger. The bifurcate calcaneocuboid ligament runs from the calcaneus to the cuboid and is often also involved in ankle sprains. Both ligaments run parallel to the sole of the foot. The calcaneo-fibular runs obliquely distally and posteriorly from the posterior edge of the lateral malleolus to the calcaneum and is approximately two fingers' width in length. It is more rounded so more palpable than the other two ligaments.

Technique

- Patient lies supported on table
- Identify and mark anterior inferior edge of lateral malleolus
- Insert needle to touch bone
- Pepper half solution around origin of ligament
- Turn needle and pepper remainder into insertion on talus

Comments

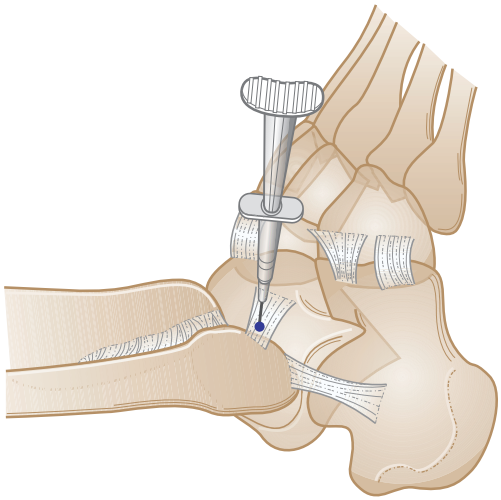
This is not a common injection, but is an option when the pain is very acute or where conservative treatment has failed in the chronic stage.

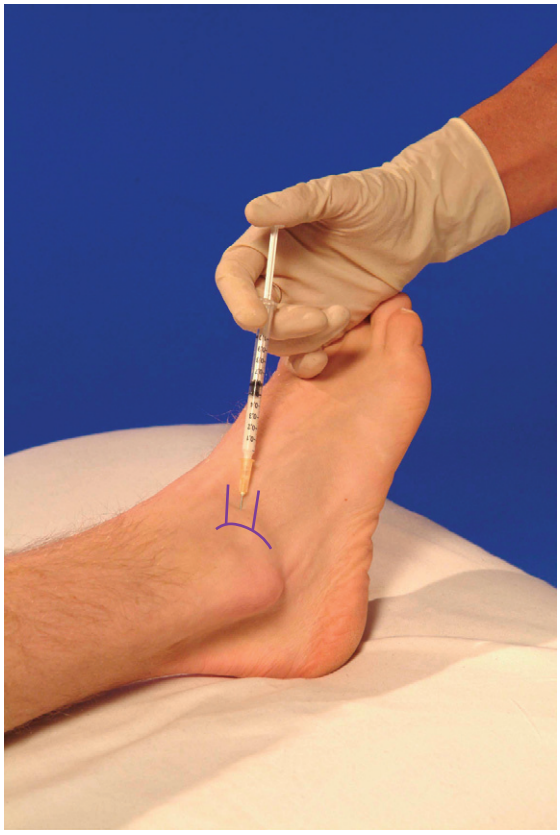
Alternative approaches

This lesion responds very well in the acute stage to a regimen of ice, elevation, gentle massage, active and passive mobilization and taping. In the chronic stage, physiotherapeutic treatment with deep massage, manipulation, muscle and balance rehabilitation works well.

Aftercare

For the first few days, ice, elevation and taping in eversion are helpful, together with a pressure pad behind the malleolus to control swelling. The patient keeps the ankle moving within the pain-free range. Exercises to strengthen the peronei and proprioception techniques usually need to be given.





ACHILLES TENDON

Chronic tendinopathy

Causes and findings

- Overuse
- Pain at posterior aspect of ankle on sides of tendon
- Painful: resisted plantarflexion on one foot or from full dorsiflexion

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Blue 23G 1.25″ (30 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The Achilles tendon lies at the end of the gastrocnemius as it inserts into the posterior surface of the calcaneus. It is absolutely contraindicated to infiltrate the body of the tendon because this is a large, weight-bearing, relatively avascular tendon with a known propensity to rupture.

Technique

- Patient lies prone with foot held in dorsiflexion over end of bed. This keeps the tendon under tension to facilitate the procedure
- Identify and mark tender area of tendon – usually along the sides
- Insert needle on medial side and angle parallel to tendon. Slide needle along side of tendon, taking care not to enter into tendon itself
- Deposit half solution while slowly withdrawing needle
- Insert needle on lateral side and repeat procedure with remaining solution

Comments

Although there are reports of tendon rupture after injection here, this has usually occurred as a result of repeated injections of large dose and volume into the body of a degenerate tendon and with excessive exercise postinjection. Because of this recognized risk therefore, we recommend always scanning the tendon prior to injecting to ascertain the extent of the degeneration (page 18). Degenerative changes within the substance of the tendon, rather than just around the periphery, would indicate an absolute contraindication to injection.

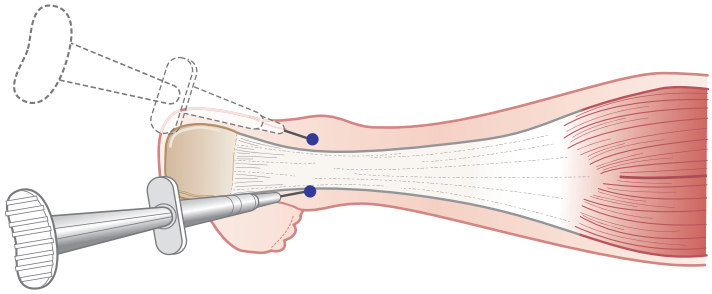
Depositing the solution along the sides is safe and effective but should not be repeated more than once in one attack. The committed athlete should preferably be offered deep friction and a graduated stretching/strengthening programme.

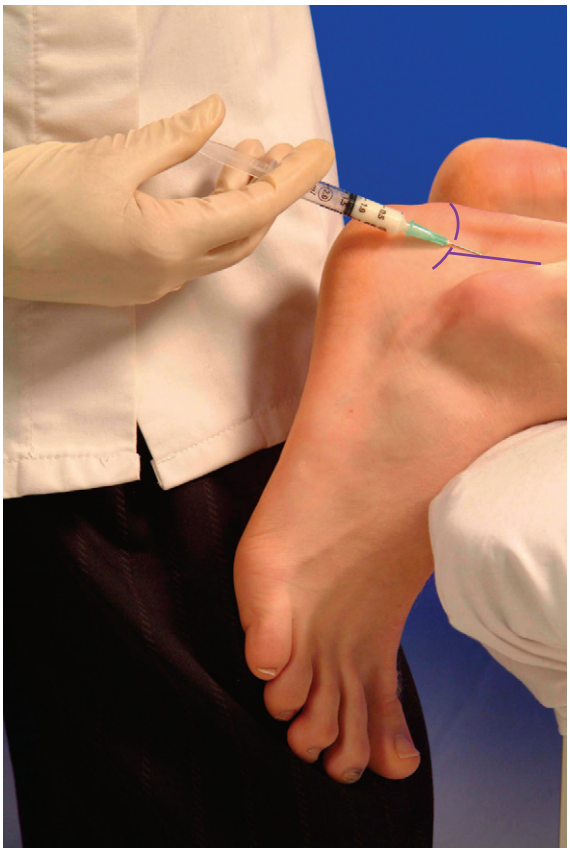
Alternative approaches

No one method has been entirely successful in treating this condition. Recent novel approaches include the continuous application of topical glyceryl trinitrate, injection of a sclerosing local anaesthetic or autologous blood preparation (page 34).

Aftercare

Absolute avoidance of any overuse is essential for about 10 days. Deep friction to the site should then be given a few times, even if the patient is asymptomatic, to prevent recurrence. When pain free, graded stretching and strengthening exercises are begun and should be continued indefinitely. Eccentric exercises, once considered the best treatment, are now shown to be not so effective but could still be tried. Orthotics and retraining in the causal activity is often necessary.





PERONEAL TENDONS

Acute or chronic tendinopathy

Causes and findings

- Overuse
- Pain above, behind or below lateral malleolus
- Painful: resisted eversion of the foot; passive inversion

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Orange 25G 0.5″ (16 mm)	10 mg	0.75 ml 2%	1 ml

Anatomy

The peroneus longus and brevis run together in a synovial sheath behind the lateral malleolus. The longus then divides to pass under the arch of the foot to insert at the base of the big toe, and brevis inserts into the base of the fifth metatarsal. The division of the two tendons is the entry point for the needle to slide inside the sheath, and can be found by having the patient hold the foot in strong eversion and palpating for the V-shaped fork of the tendons.

Technique

- Patient lies supine with foot supported in some medial rotation
- Identify and mark division of the two tendons
- Insert needle perpendicularly at this point, turn and slide horizontally under skin towards malleolus
- Deposit solution into combined tendon sheath. There should be minimal resistance and often a sausage-shaped bulge is observed

Comments

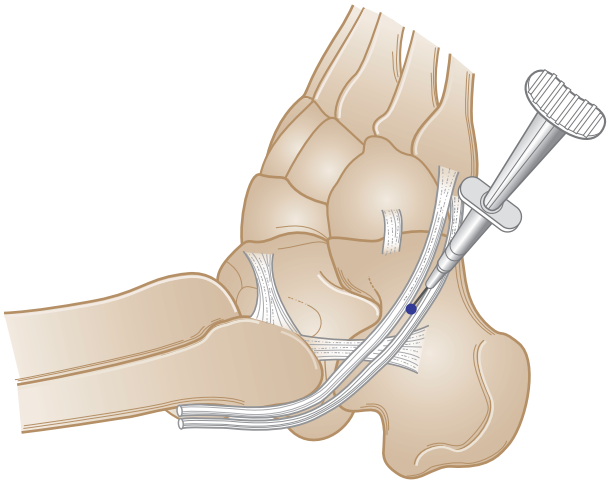
This lesion often occurs together with an acutely sprained lateral ligament of the ankle. Examination of the joint should ascertain if one or more ligaments are affected and all should be treated if necessary.

Alternative approaches

Occasionally the tendinopathy occurs at the insertion of the peroneus brevis. The same amount of solution is then peppered into the teno-osseous junction by inserting the needle parallel to the skin to touch the base of the fifth metatarsal.

Aftercare

Avoid any overuse for about a week. Resolution of symptoms should then lead to consideration of change in footwear, orthotics and strengthening of the evertors.



PLANTAR FASCIA

Acute fasciitis

Causes and findings

- Idiopathic, overuse, poor footwear
- Pain on medial aspect of heel pad on weightbearing in the morning
- Tender area over medial edge of origin of fascia from calcaneus

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Green 21G 2″ (40–50 mm)	20 mg	1.5 ml 2%	2 ml

Anatomy

The plantar fascia, or long plantar ligament, arises from the medial and lateral tubercles on the inferior surface of the calcaneus. The lesion is invariably found at the medial head and the area of irritation can be palpated by deep pressure with the thumb.

Technique

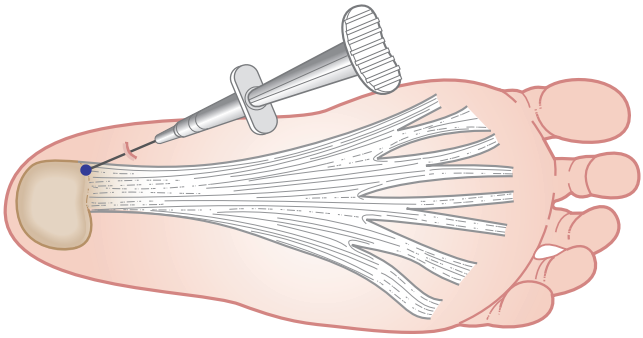
- Patient lies prone with foot supported in dorsiflexion
- Identify tender area on heel
- Insert needle perpendicularly into medial side of soft part of sole just distal to heel pad. Advance at 45° towards calcaneus until it touches bone
- Pepper solution in two rows into fascia at its medial bony origin

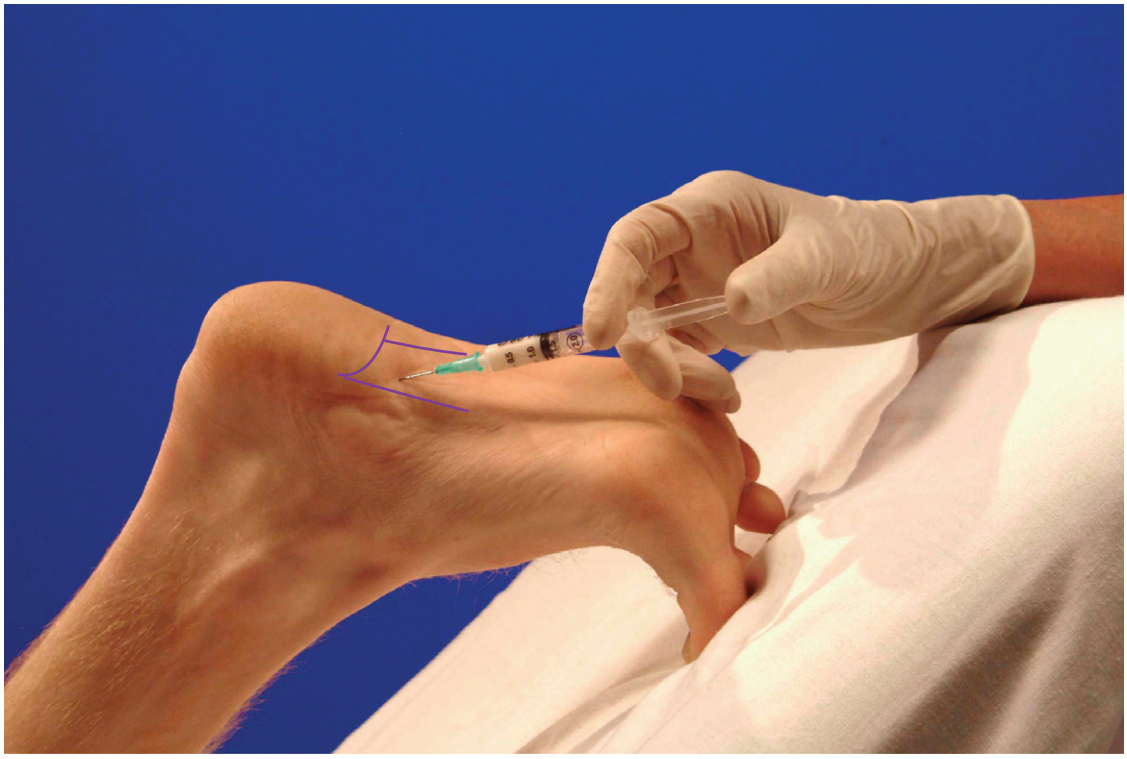
Comments

Although this would appear to be an extremely painful injection, this approach is much kinder than inserting the needle straight through the heel pad, and patients tolerate it well.

Aftercare

A heel support is used for at least 1 week after the injection, followed by intrinsic muscle exercise and stretching of the fascia. Standing on a golf ball to apply deep friction can be helpful and orthotics can be applied. Taping can also be used.





MORTON'S NEUROMA

Plantar digital neuritis

Causes and findings

- Poor footwear, overpronated foot, abnormal gait
- Burning pain/paraesthesia in first or second interspace between metatarsal heads
- Painful: squeezing metatarsal heads or pressure at site

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Blue 23G 1″ (20 mm)	20 mg	Nil	0.5 ml

Anatomy

A painful fusiform swelling develops in the common digital nerve below the transverse intermetatarsal ligament, usually in the first or second interspace between or slightly distal to the metatarsal heads. The history of burning pain, especially at night, and squeezing of the heads or stretching the nerve by hyperextending the toes usually is indicative of this lesion.

Technique

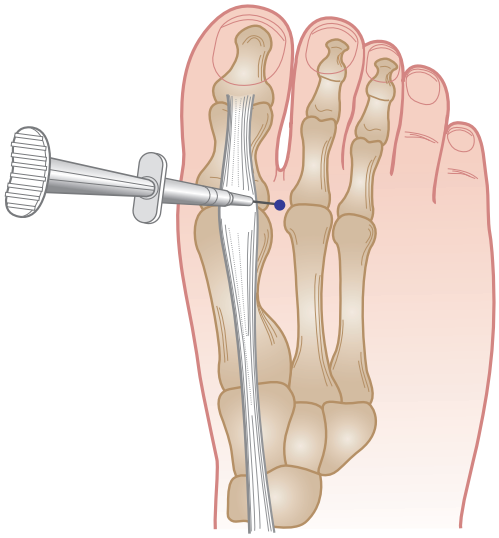
- Patient sits supported with foot placed flat on the table
- Identify and mark tender area between the metatarsal heads
- Insert needle perpendicularly and gently through dorsal skin at this point
- If a sharp burning sensation is reported, slightly withdraw needle tip
- Deposit solution around inflamed neuroma

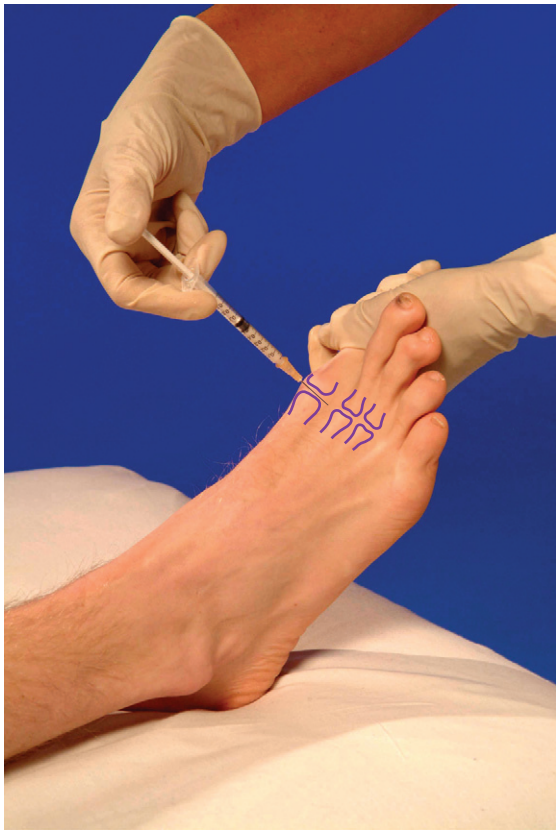
Comments

As with all injections around neural tissue, care must be taken to approach the nerve slowly as the sudden sharp pain induced may make the patient jump. The sensation, however, is helpful in confirming correct placement. The drug is deposited around the neuroma, not into the substance of the nerve.

Aftercare

This injection is often successful in relieving symptoms, but these may recur unless the patient is prepared to forego wearing thin-soled, very high heels or other inappropriate footwear. Placing a small pad just proximal to the metartarsal head to lift the bone and reduce the compression for the first week post injection is helpful. Recurrent return of symptoms usually indicates that the patient should discuss surgical options with a foot surgeon.





SUMMARY OF SUGGESTED LOWER LIMB DOSAGES

Area	Syringe	Needle	Kenalog	Lidocaine	Total volume
Hip					
Hip joint/gluteal bursa	5 ml	Spinal 3.5″	40 mg	4 ml 1%	5 ml
Psoas bursa	5 ml	Spinal 3.5″	20 mg	2 ml 2%	2.5 ml
Trochanteric bursa	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Adductor tendon	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Hamstring tendon/ ischial bursa	2 ml	Green 2″	20 mg	1.5 ml 2%	2 ml
Lateral cutaneous nerve	1 ml	Green 2″	20 mg	Nil	0.5 ml
Knee			**Adcortyl**		
Knee joint	10 ml	Green 1.5″	40 mg	4–6 ml 1%	5–10 ml
Superior tibiofibular joint	2 ml	Orange 0.5″	20 mg	1 ml 2%	1.5 ml
Iliotibial bursa	2 ml	Blue 1″	20 mg	1.5 ml 2%	2 ml
Infrapatellar	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Pes anseurine bursae	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Coronary ligament	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Medial collateral ligament	2 ml	Blue 1.25″	20 mg	1 ml 2%	1.5 ml
Infrapatellar tendon	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Quadriceps expansion	2 ml	Orange 0.5″	10 mg	1.75 ml 2%	2 ml
Ankle and Foot					
Ankle joint	2.5 ml	Blue 1.25″	30 mg	1.75 ml 2%	2.5 ml
Subtalar joint	2 ml	Blue 1.25″	30 mg	1.25 ml 2%	2 ml
Midtarsal joints	2 ml	Blue 1″	20 mg	1.5 ml 2%	2 ml
Toe joints	1–2 ml	Orange 0.5″	10–20 mg	0.5–1 ml 2%	0.75–1.5 ml
Achilles bursa/tendon	2 ml	Blue 1.25″	20 mg	1.5 ml 2%	2 ml
Lateral/deltoid ligament	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Peroneal tendons	1 ml	Orange 0.5″	10 mg	0.75 ml 2%	1 ml
Plantar fascia	2 ml	Green 2″	20 mg	1.5 ml 2%	2 ml
Morton's neuroma	1 ml	Blue 1″	20 mg	Nil	0.5 ml

SECTION 5

SPINAL INJECTIONS

SPINAL INJECTION GUIDELINES

We strongly recommend that clinicians wishing to give spinal injections attend recognized training courses and undergo a period of supervised practice with an experienced colleague before attempting them on their own.

OVERVIEW

Low back pain without disc herniation is the most common problem among chronic pain disorders, but a patho-anatomical cause can be established in only 15 % of all cases.[1] Treatments to relieve this affliction have been many, among them spinal injections – engendering much controversy in the literature; opinions about efficacy, safety and relevance have differed greatly since their inception in the 1920s, with many studies considered poor quality.[2–17]

Although epidural injections are one of the most commonly used invasive interventions in the treatment of low back pain, with or without radicular pain, there is currently little consensus about this technique and wide variation in practice.[21] There is also no agreement on the most effective approach for lumbar epidural injection, whether to use steroid, local anaesthetic, saline or a combination, or the exact volume required. Depot steroids are not licensed for spinal use[18,19] but orthopaedic and pain specialists, rheumatologists and others use these injections extensively.[20] The caudal route of administration may require a larger volume but is least likely to cause dural puncture.[22,23]

A paucity of well designed, randomized controlled studies, and a lack of statistically significant results in the existing literature mean that a solid foundation for the effectiveness of spinal injection therapy is lacking.[9] NICE, the UK National Institute for Health and Clinical Excellence, recommended that patients with persistent non-specific low back pain should not be offered injections of therapeutic substances,[24] but what impact this has had on clinical practice is uncertain.

A Cochrane Review found minor side-effects such as headache, dizziness, transient local pain, tingling, numbness and nausea reported in a small number of patients in only half the trials reviewed. The review concluded that there is no strong evidence for or against the use of any type of injection therapy for individuals with subacute or chronic low-back pain.[10]

SAFETY

All the contraindications listed in Section 2 apply, but particularly:

- anticoagulant therapy with warfarin is an absolute contraindication.

The incidence of intravascular uptake during lumbar spinal injection procedures is approximately 8.5%; it is greater in patients over 50, and if the caudal route is used rises to 11%. Absence of flashback of blood on pre-injection aspiration does not predict extravascular needle placement.[31] Epidural steroid injection is safe in patients receiving aspirin-like antiplatelet medications, with no excess risk of

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serious haemorrhagic complications, i.e. spinal haematoma. Increased age, large needle gauge, needle approach, insertion at multiple interspaces, number of needle passes, large volume of injectant and accidental dural puncture are all relative risk factors for minor haemorrhagic complications.[32]

Safety precautions and strict aseptic techniques are the same as for all injections. An additional hazard is the rare possibility of an intrathecal injection of local anaesthetic which may be avoided by using **corticosteroid alone**. The rationale is that the benefit of the brief relief of pain and the diagnostic information obtained from using an anaesthetic does not outweigh the potential risks. Normal saline can be added or Adcortyl used instead of Kenalog if additional volume is required.

New neurological symptoms or worsening of pre-existing complaints that persist for more than 24 hours (median duration of symptoms 3 days, range 1–20 days) might occur after epidural injection,[32] but in the authors' experience this is rare.

The British Society for Rheumatology and the Royal College of Anaesthetists produce guidelines for the use of epidural injections. We commend them to all practitioners who give these injections. They can be found at:

- www.rheumatology.org.uk
- www.rcoa.ac.uk

ACCURACY

Performing spinal injections under imaging can ensure correct placement but requires specialized training and is expensive to perform, especially if done in theatre; many doctors perform these techniques 'blind' and obtain satisfactory results.

Accuracy of blind caudal epidural injections compared with targeted placement has been assessed in a few studies. In one, successful placement on the first attempt occurred in three out of four subjects. Results were improved when anatomical landmarks were identified easily (88%) and no air was palpable subcutaneously over the sacrum when injected through the needle (83%). The combination of these two signs predicted a successful injection in 91% of attempts. In another study blind injections were correctly placed in only two out of three attempts, even when the operator was confident of accurate placement. When the operator was less certain, the success rate was less than half and if the patient was obese the success rate reduced even further. In a third prospective randomized, double-blind trial, the results showed no advantage of spinal endoscopic placement compared with the more traditional caudal approach.[26–29,34,39]

EFFICACY

Lumber epidurals: a systematic review of epidural corticosteroids for back pain found at least 75% pain relief in the short term (1–60 days) with the number needed to treat (NNT) of 7 (7–16) and at least 50% pain relief in the long term (3–12 months) with NNT of 13 (7–314).[3] A randomized, double-blind, controlled trial concluded that lumbar interlaminar epidural

of local anaesthetic with steroid was effective in 86% of patients, and without steroid in 74%.[31]

A systematic review indicated positive evidence (Level II-2) for *short-term* relief of pain from disc herniation or radiculitis utilizing blind interlaminar epidural steroid injections; there was less strong evidence for *long-term* pain relief for these conditions and for the short- and long-term relief of pain from spinal stenosis and from discogenic pain without radiculitis or disc herniation.[25] Another review of both caudal and lumbar epidurals also concluded that the best studies showed inconsistent results and benefits were of short duration only.[6] Yet another showed strong evidence for epidurals in the management of nerve root pain due to disc prolapse, but limited evidence in spinal stenosis.[22] A multicentre randomized controlled trial of epidurals for sciatica reported significant relief at 3 weeks but no long-term benefit.[14]

In the past, large volumes have been injected into the epidural space;[33] however, a total injection volume of 8 ml is sufficient for a caudal epidural injection to reach the L4/5 level.[34]

Selective guided nerve-root injections of corticosteroids are significantly more effective than those of bupivacaine alone in obviating the need for operative decompression for 13–28 months following the injections in operative candidates. This finding suggests that patients who have lumbar radicular pain at one or two levels should be considered for treatment with selective nerve-root injections of corticosteroids prior to operative intervention. A significantly greater proportion of patients treated with transforaminal injection of steroid achieve relief of pain compared with those treated by transforaminal injection of local anesthetic or saline or intramuscular steroids.[30] When symptoms have been present for more than 12 months, local anaesthetic alone may be just as effective as steroid and local anaesthetic together.

When conservative measures fail, nerve-root injections are effective in reducing radicular pain in patients with osteoporotic vertebral fractures and no evidence of nerve root palsy. These patients may be considered for this treatment before percutaneous vertebroplasty or operative intervention is attempted.[35,36,38]

Injection of the sacroiliac joints for painful sacroiliitis appears to be safe and effective. It can be considered in patients with contraindications or complications with NSAIDs, or if other medical treatment is ineffective,[37] though often manipulative techniques can obviate the need for an injection. However, accurate placement of the drug without the use of fluoroscopy is estimated to be successful in only 12 % of patients.[40]

INDICATIONS FOR SPINAL INJECTION

The techniques described here include caudal epidural, nerve root, facet joint, sacroiliac joint and sacrococcygeal joint injections and the far less common technique for cervical nerve root pain. The choice between giving a caudal or nerve root injection can be aided by the site of pain; if this is clearly unilateral in the lumbar area, or radiating down one leg, a nerve root injection may be effective. If the pain is bilateral or central in the lumbar spine, a caudal epidural may be a better choice; however, this guide is not an absolute.

The following are the main indications for caudal and nerve root injections:

- Acute back and/or leg pain where pain makes manipulation impossible to perform
- Chronic back and/or leg pain where conservative treatment has failed
- Prior to considering surgery.

Older patients with chronic back pain and stiffness increased on active extension may benefit from facet joint injections. A retrospective study of patients with spinal stenosis found that 35 % of patients had at least 50 % improvement; those with spondylolisthesis, single level stenosis and older than 73 had better outcomes.[28] Less commonly, injections for coccydinia or sacroiliac joint pain can be attempted in cases of acute traumatic or post-natal pain.

SUMMARY

There is a wide variation of opinion about the efficacy of spinal injections for back pain; adverse effects are generally minor and it cannot be ruled out that specific subgroups of patients may respond to a specific type of injection therapy. A cost-effective intervention which may be performed safely as an outpatient procedure and rapidly relieve pain, even in the short term, is worth considering for carefully selected patients with both acute and chronic low back pain provided that, as with all injection techniques, resuscitation facilities are available and the guidelines on aseptic technique are strictly followed.

EXAMINATION OF THE SPINE

The capsular pattern is a set pattern of loss of motion for each joint. It indicates that there is some degree of joint capsulitis caused by degeneration, inflammation or trauma. There may be a hard end feel in advanced capsulitis.

Cervical spine tests

Active:	flexion	**Resisted:**	shoulder abduction C5
	rotations		shoulder lateral rotation C5
	side flexions		shoulder medial rotation C6
	extension		elbow flexion C6
Passive:	rotations		elbow extension C7
	side flexions		shoulder adduction C7
	extension		wrist extension C6
			wrist flexion C7
			thumb extension C8
			finger adduction T1

Reflexes: brachioradialis C5, biceps C6, triceps C7
Cervical capsular pattern: equal loss of *rotations* and *side flexions*, more loss of *extension* than *flexion*

Lumbar spine tests

Active:	extension	**Resisted:**	foot plantarflexion S1
	side flexions		hip flexion L2
	flexion		foot dorsiflexion L4
			big toe extension L4/5
Passive:	hip flexion	**Resisted:**	foot eversion L5/S1
	hip rotations		knee extension L3
			knee flexion S1
			glutei S1
	straight leg raise		

Reflexes: knee L3, ankle L5, S1/2
Lumbar capsular pattern: equal loss of *side flexions*, more loss of *extension* than *flexion*

CAUDAL EPIDURAL

Acute or chronic low back pain or sciatica

Causes and findings

- Disc lesion, acute nerve entrapment
- Central or bilateral pain in low back with or without sciatica or root signs
- Painful: flexion and usually side flexion away from pain with nerve root tension signs

Equipment

Syringe	Needle	Adcortyl	Lidocaine	Total volume
5 ml	Green 21G 1.5″ (40 mm)	40 mg	Nil	4 ml

Anatomy

The spinal cord ends at the level of L1 and the thecal sac ends at S2 in most individuals. The aim of this injection is to pass a disinflaming solution through the sacral hiatus and up the canal so that it bathes the posterior aspect of the intervertebral disc, anterior aspect of the dura mater and any affected nerve roots centrally. The sacral cornua are two prominences that can be palpated at the apex of an equilateral triangle drawn from the posterior superior spines on the ileum to the coccyx. There is a thick ligament at the entrance to the canal. The angle of the curve of the canal varies widely and the placement of the needle reflects this.

Technique

- Patient lies prone over small pillow
- Identify sacral cornua at base of imaginary triangle with thumb
- Insert needle between cornua and pass horizontally through ligament
- Pass needle a short distance up canal adjusting angle to curve of sacrum
- Aspirate to ensure needle has not penetrated thecal sac or blood vessel
- Slowly inject solution into epidural space
- Keep hand on sacrum to palpate for swelling caused by suprasacral injection

Comments

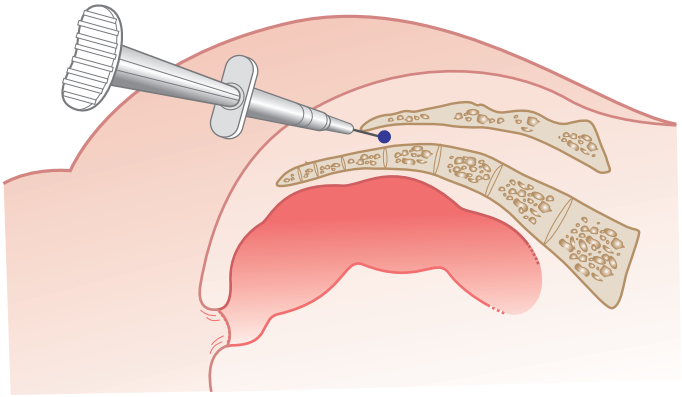
Occasionally the canal is difficult to enter. This might be because of a bifid or very small canal or because the angle of the sacrum is very concave. If this is encountered, a small amount of local anaesthetic can be injected into the ligament to make penetration more comfortable and reangulation of the needle might be necessary. If clear fluid or blood is aspirated at any point the procedure is abandoned and attempted a few days later.

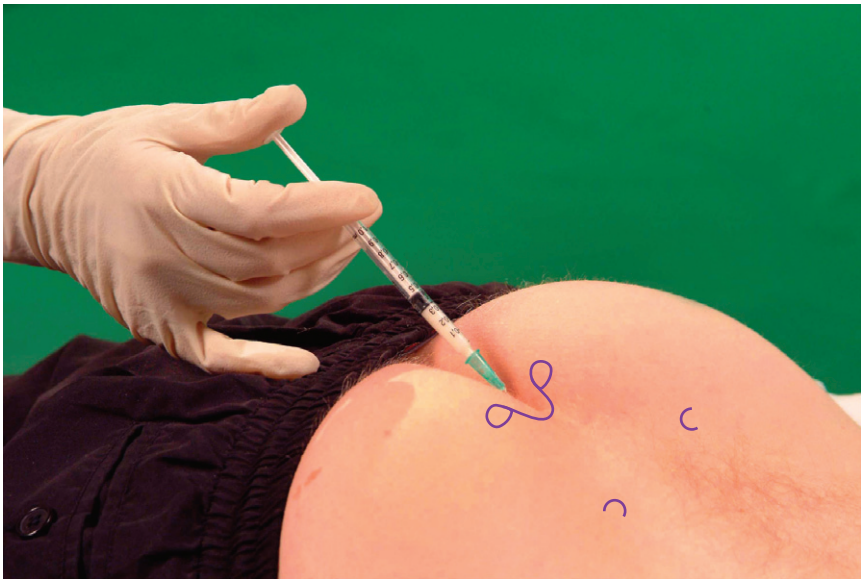
Alternative approach

If the affected level is higher than the common L5/S1 level or the patient is large, more volume may be required to reach these levels. In this case we recommend the addition of up to 10 ml of normal saline, depending on the level of the lesion and the size of the patient.[39]

Aftercare

The patient is advised to keep active within pain limits and is reassessed about 10 days later. If the injection has only partially helped it can be repeated as long as improvement continues. The causes of the back pain should then be addressed – weight, posture, work positions, lifting techniques, exercise, abdominal control, etc.





LUMBAR FACET JOINT

Chronic capsulitis

Causes and findings

- Osteoarthritis, traumatic capsulitis, ankylosing spondylitis, spondylolysis
- Uni- or bilateral low back pain, sometimes with dull vague aching down leg/s
- Painful: capsular pattern limitation, in spondylolysthesis combined extension with side flexion to the painful side may be the most painful movement.

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Spinal 22G 3–5" (90 mm)	40 mg	Nil	1 ml

Anatomy

The lower lumbar facet or zygaphophyseal joints lie lateral to the spinous processes – approximately one finger width at L3, one and a half at L4 and two fingers' width at L5. They cannot be palpated but are located by marking a vertical line along the centre of the spinous processes and horizontal lines across *between* each process. The posterior capsule of the joint is found by inserting the needle the correct distance for that level laterally on the horizontal line.

Technique

- Patient lies prone on small pillow to aid localization of spinous interspace
- Identify and mark one or more tender levels
- Insert needle at first selected level vertically
- Angle needle slightly cephalad and medially and pass slowly down to bone
- Aspirate to ensure needle point is not intrathecal or in blood vessel
- Deposit solution into and around capsule
- Withdraw needle and repeat at different levels if necessary

Comments

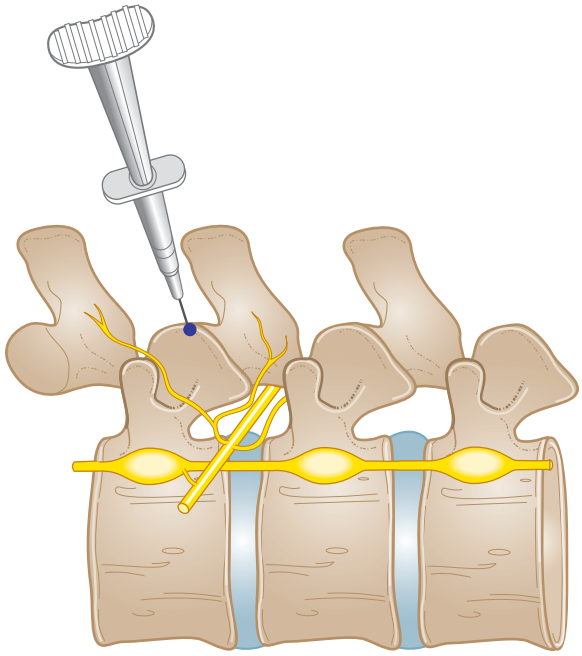
Sometimes it is impossible to enter the joint, but controlled studies have shown that depositing the solution into the capsule can be therapeutically effective[11].

Alternative approach

These injections are often performed under imaging but this is less cost effective.

Aftercare

Patient avoids excessive movement while maintaining activity. Abdominal strengthening and mobilizing exercises should be performed regularly. Occasional mobilization and hamstring stretching will help to maintain flexibility. A lumbar support may be used during activities.



LUMBAR NERVE ROOT

Nerve root inflammation

Causes and findings

- Spinal stenosis, nerve-root entrapment
- Acute or chronic sciatica with or without root signs
- Painful: flexion and usually side flexion away from pain plus nerve root tension signs

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Spinal 22G 3.5" (90 mm)	40 mg	Nil	1 ml

Anatomy

The lumbar nerve roots emerge obliquely from the vertebral canals between the transverse processes at the level of the spinous process. Draw a vertical line along the centre of the spinous processes and horizontal lines at each spinous level. A thumb's width laterally along the horizontal line marks entry site for the needle.

Technique

- Patient lies prone over small pillow to aid localization of spinous processes
- Identify spinous process at painful level and mark spot along horizontal line
- Insert needle and pass perpendicularly to depth of about 3" (7 cm)
- Aspirate to ensure needle point is not intrathecal
- Inject solution as a bolus around nerve root

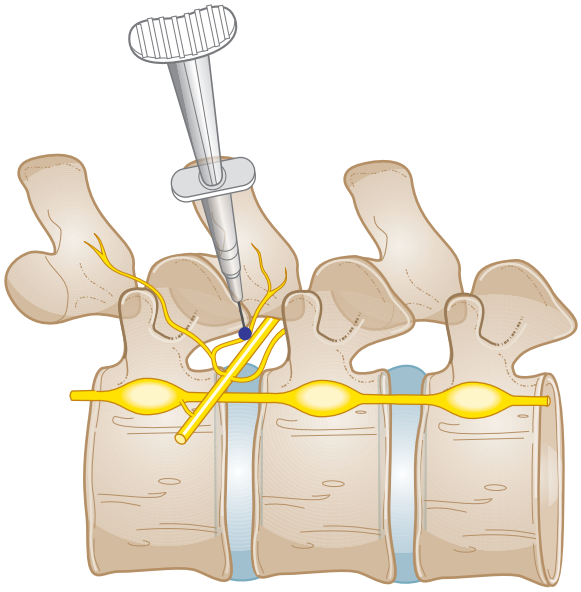
Comments

This injection can be especially effective when the patient is in severe pain and conservative manual therapy techniques are impossible to administer. It can also be given when caudal epidural has proved unsuccessful – the caudal is technically an easier procedure but the solution might not reach the affected part of the nerve root. The needle must be repositioned if it encounters bone at a distance of about 2" (5 cm) as this means it is touching the lamina or facet joint. Equally, repositioning is necessary if the patient complains of sharp 'electric shock' sensation because the needle will be in the nerve root. If clear fluid is aspirated the needle is intrathecal and the procedure must be abandoned, although it can be attempted a few days later. Two levels can be infiltrated at a time. A large patient may require a longer needle.

If the first level injected does not relieve the symptoms, a level above or below can be tried. This is well worth trying before considering surgery.

Aftercare

Patient keeps mobile within pain limits and is reassessed 10 days later. Repeat as necessary.



SACROCOCCYGEAL JOINT

Coccydynia – strain of coccygeal ligaments, subluxation

Causes and findings

- Postnatal, trauma e.g. fall onto buttock or prolonged sitting on hard surface
- Pain localized over sacrococcygeal joint
- Pain on sitting or bearing down
- Tender on joint line, coccyx might be subluxed

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Blue 23G 1" (25 mm)	20 mg	0.5 ml 2 %	1 ml

Anatomy

The ligaments at the sacrococcygeal joint line are usually very tender and can be palpated both on the dorsal and ventral surfaces. The gloved finger palpates the angle of the coccyx rectally to check for subluxation of the bone.

Technique

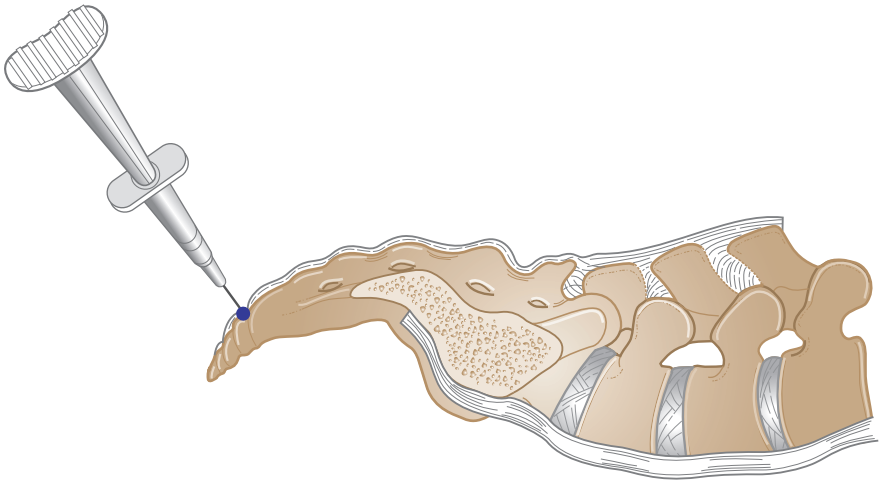
- Patient lies prone over small pillow
- Identify and mark tender site on dorsum of coccyx at joint line
- Insert needle down to touch bone
- Pepper solution around into tender ligaments

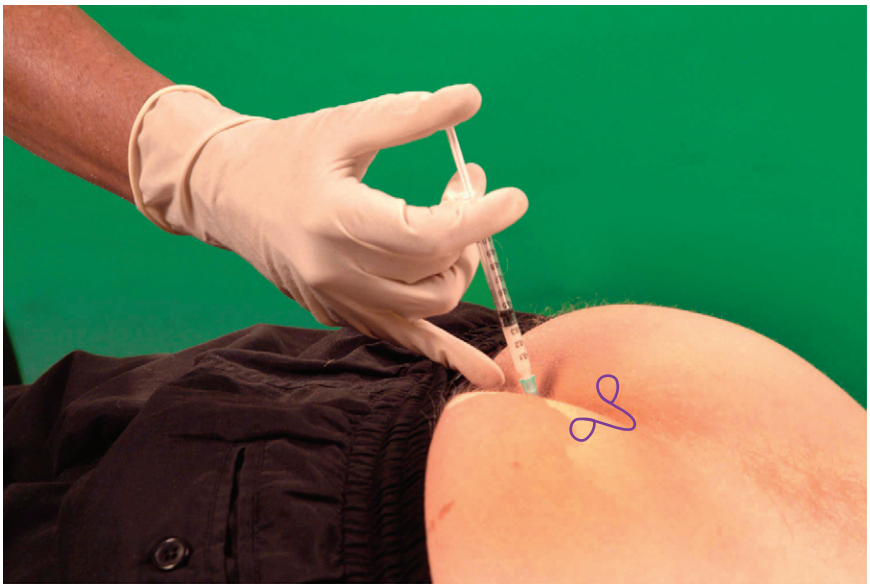
Comments

Pain in this area can be symptomatic of psychological or psychosexual distress, in which case the appropriate treatment/advice is required. With somatic pain the protocol above appears to work either well or not at all. Surgery is not usually indicated or particularly successful.

Aftercare

Advise patient to avoid sitting on hard surfaces and to use a ring cushion. At follow-up 10 days later, manipulation of the coccyx might be necessary to correct any subluxation; the anti-inflammatory effect of the steroid enables this to be performed with less discomfort. The gloved finger is inserted into the rectum and a firm anteroposterior movement applied. Sometimes an audible click can be heard and some days later the relief of pain is apparent.





SACROILIAC JOINT

Acute or chronic sprain or capsulitis

Causes and findings

- Acute sacroiliitis, ankylosing spondylitis
- Chronic ligamentous pain after successful manipulation
- Usually female – often pre- or post-partum or traumatic incident such as fall onto buttocks
- Pain over buttock, groin or occasionally down posterior thigh to calf
- Pain after rest, or long periods of sitting or standing
- Painful: stressing posterior ligaments in hip flexion, oblique and transverse adduction, and anterior ligaments in hip flexion, abduction and external rotation

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
2 ml	Spinal 22G 3" (75 mm)	20 mg	1.5 ml 2 %	2 ml

Anatomy

The sacroiliac joint surfaces are angled obliquely posteroanteriorly, with the angle being more acute in the female. The dimples at the top of the buttocks indicate the position of the posterior superior iliac spines. The easiest entry point is usually found in a dip just below and slightly medial to the spines.

Technique

- Patient lies prone over small pillow
- Identify and mark posterior superior iliac spine on affected side
- Insert needle a thumb's width medial and just below this bony landmark at level of second sacral spinous process
- Angle needle obliquely anterolaterally at an angle of about 45°
- Pass needle between sacrum and ilium until a ligamentous resistance is felt
- Inject solution as a bolus within joint if possible, or pepper posterior capsule

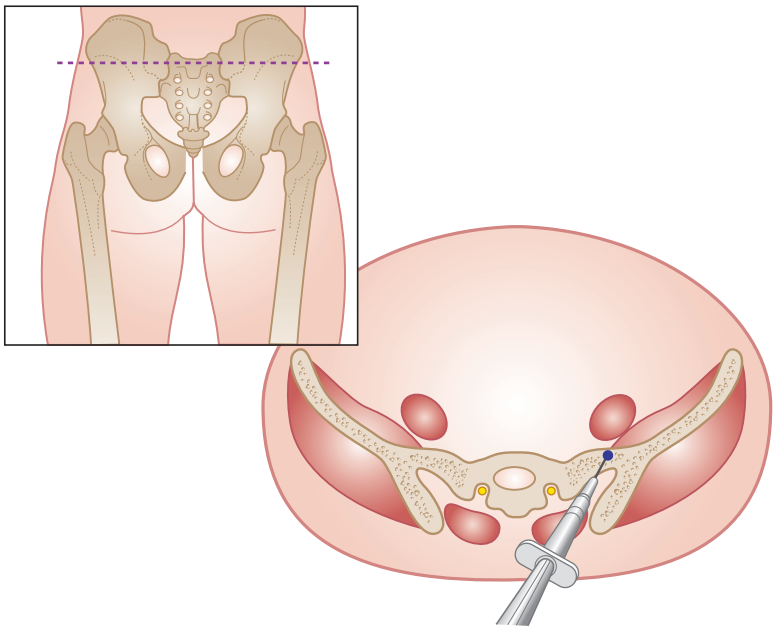
Comments

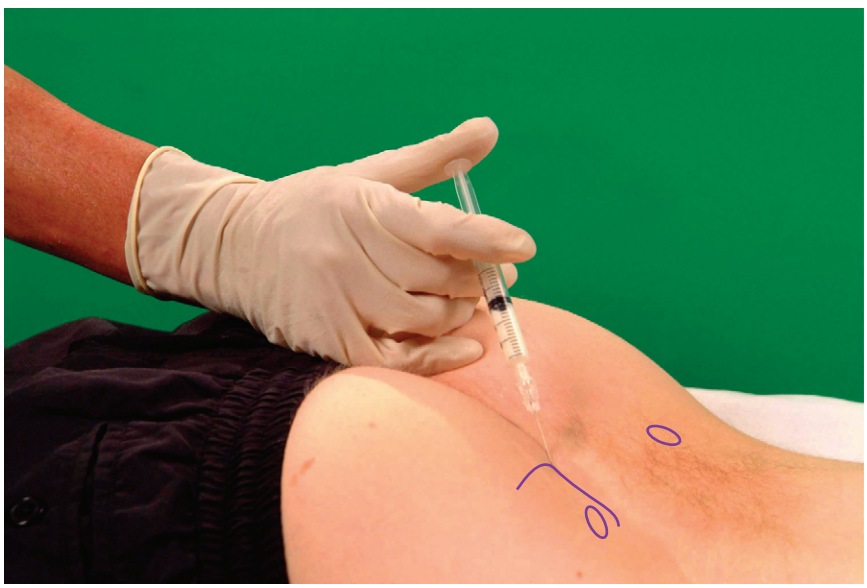
This is not a very common injection; usually manipulation, mobilization and exercise techniques clear the majority of chronic sacroiliac joint symptoms.

The needle often comes up against bone when attempting this injection and then has to be manoeuvred around to allow for the variations in bony shape before entering the joint space. It is unusual to have to repeat this injection and the joint can often be successfully manipulated a week later if necessary.

Aftercare

Movement within the pain-free range is encouraged – a lunging motion with the foot up on a chair can help relieve pain, as can moderate walking. The patient should avoid hip abduction positions and sit with back supported. A temporary belt is worn if the joint is unstable, and sclerosing injections can be given to increase ligamentous stability.





CERVICAL FACET JOINT

Acute or chronic capsulitis

Causes and findings

- Osteoarthritis, rheumatoid arthritis or traumatic capsulitis
- Pain in posterior neck, up to head, into scapula or to point of shoulder
- Increased by sleeping in awkward positions and end-of-range movement
- Painful capsular pattern limitation, tender over one or more facet joints

Equipment

Syringe	Needle	Kenalog	Lidocaine	Total volume
1 ml	Green 21G 1.5–2″ (40–50 mm)	20 mg	Nil	0.5 ml

Anatomy

The facet or zygaphophyseal joints in the cervical spine are plane joints lying at angles of approximately 30–45° to the vertical. They can be palpated by identifying the spinous process and moving a finger's width laterally, and are felt as a flat pillar.

Technique

- Patient lies on unaffected side with roll under neck
- Neck is held in flexion and slight side flexion away from the painful side
- Identify and mark the tender joint or joints
- Insert needle parallel to spinous process below and angle at 45°cephalad
- Pass through extensors towards upper ear until point touches bone
- Gently 'walk' along bone until needle touches joint capsule
- Aspirate to ensure needle point is not intrathecal or in blood vessel
- Pepper solution into capsule and inject intracapsular in bolus if possible

Comments

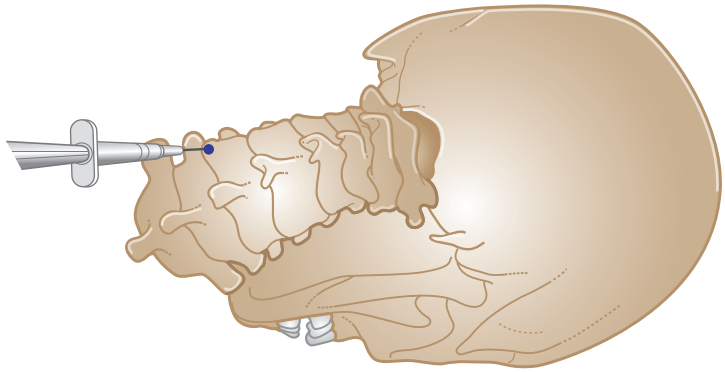
This an uncommon injection and, although it appears alarming, it is perfectly safe provided great care is taken that the needle always lies parallel to the spinous process and never angles medially, and that the point touches bone before depositing the solution. The results in the osteoarthritic neck can be good for several months, provided the patient does not strain the neck and maintains mobility and good posture as above.

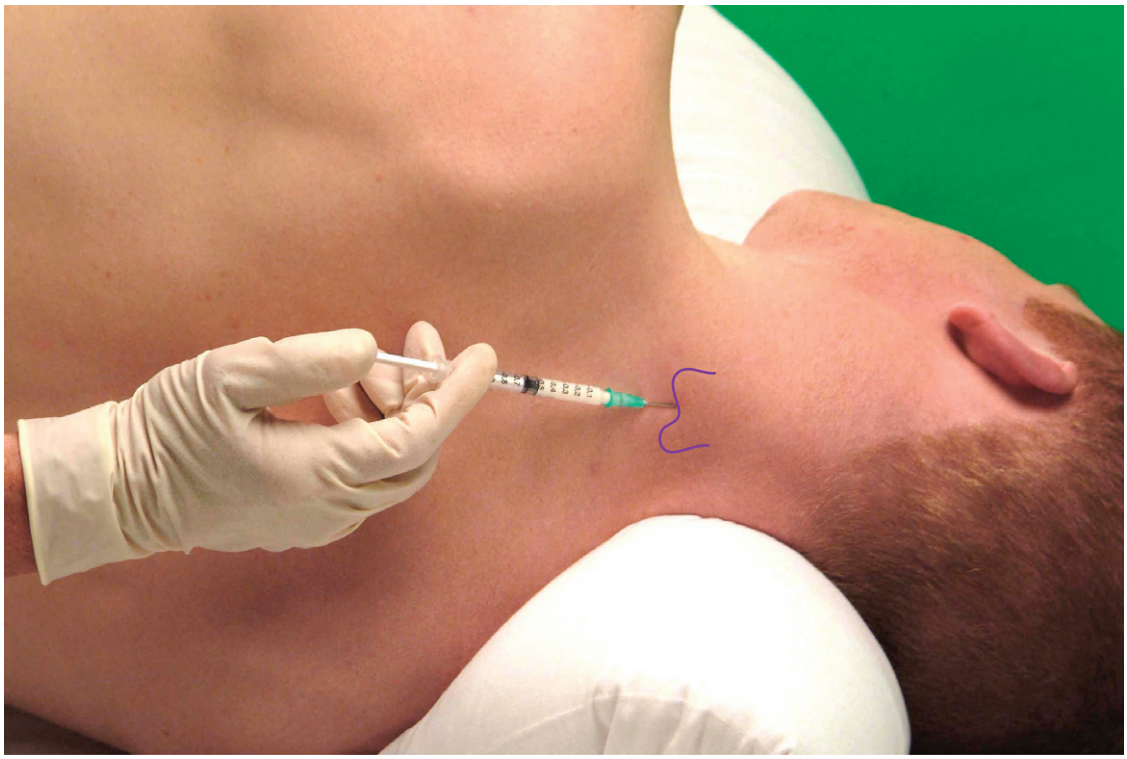
Alternative approach

This injection can also be done under imaging which ensures correct placement but is less cost effective.

Aftercare

Patient maintains gentle movement, continues correct posture and is careful to sleep with a suitable number of supporting pillows to maintain the head in a neutral position. Prone lying should be avoided. Manual traction, mobilizing and sustained stretching techniques together with friction massage to the joint capsule helps maintain comfortable movement.





SUMMARY OF SUGGESTED SPINAL DOSAGES

Syringe	Needle	Steroid	Lidocaine	Total volume
Caudal epidural:				
5 ml	21G 1.5" Green	40 mg/Adcortyl	Nil	4 ml
Or 10 ml		40 mg/Adcortyl	Saline 4 ml	10 ml
Lumbar facet joint:				
1 ml	22G 3–3.5" Spinal	40 mg/Kenalog	Nil	1 ml
Lumbar nerve root:				
1 ml	22G 3.5" Spinal	40 mg/Kenalog	Nil	1 ml
Sacrococcygeal joint:				
1 ml	23G 1" Blue	20 mg/Kenalog	0.5 ml 2%	1 ml
Sacroiliac joint:				
2 ml	22G 3" Spinal	40 mg/Kenalog	1.5 ml 2%	2 ml
Cervical facet joint:				
1 ml	21G 1.5–2" Green	20 mg/Kenalog	Nil	0.5 ml

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